Independent Qualified Registered Professional Engineer Support to Demonstration Bulk Vitrification Project

CH2M Hill Requisition # 114648

IQRPE Design Assessment Report No. DR-009, Rev. 1

Review of

Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package, RPP-24544, Revision C

Section 2.2, Waste Dryer System (90 Percent Design)

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1.0 INTRODUCTION

The Washington State Department of Ecology (Ecology) has issued a permit for the Demonstration Bulk Vitrification System (DBVS) that mandates the use of an Independent Qualified Registered Professional Engineer (IQRPE) to perform a third-party independent review of the design of Washington Department of Ecology sensitive portions of the DBVS project. TechnoGeneral Services Company (TGS) has prepared this IQRPE Design Assessment Report in conjunction with Dana Engineering, Inc. (DEI), at the request of CH2M Hill Hanford Group, Inc. (CH2M HILL), the project co-operator. TGS is the IQRPE of record for this project

1.1 Project Description

The DBVS is a demonstration waste treatment plant operated under a Research, Development and Demonstration (RD&D) Permit issued by Ecology. The RD&D Permit is issued to the U.S. Department of Energy, Office of River Protection (DOE-ORP) and CH2M HILL. The DBVS plant will be located at the 200 West Area of the Hanford Site. The DBVS is being designed, constructed, and operated by AMEC, an engineering/services company from Vancouver, British Columbia, under contract to CH2M HILL. AMEC is tasked to comply with the RD&D Permit. Figure 1 is a three-dimensional graphic view of the DBVS project.

The DBVS is designed to process a liquid salt solution of low-activity mixed waste (LAW) originating from Tank 241-S-109. Tank 241-S-109 is located adjacent to the DBVS facility. The LAW is to be converted into solid glass form by drying the LAW, mixing the LAW in dried form with soil, and melting it with an electric current. The project is intended to demonstrate the viability of immobilizing LAW from the tank farm utilizing a proprietary AMEC vitrification system. The demonstration is to involve treating up to 600,000 gal of waste in 18 months, producing up to 50 In-Container Vitrification (ICV^{TM}) melt boxes of stabilized vitrified waste.

About 13,170 gal of LAW are to be processed in each melt box. A detailed description of the process is provided in Attachments AA and BB of the RD&D Permit.

1.2 Design Review Requirements

Many of the components of the DBVS will handle dangerous or mixed waste and are regulated by Washington Department of Ecology in the RD&D Permit. The RD&D Permit requires an IQRPE review of the design of these components prior to installation.

The Compliance Schedules, Sections IV.A.8 and V.I of the RD&D Permit, define the design documents to include drawings, specifications, calculations and other information as deemed necessary to support the design. The RD&D Permit identifies 7 systems, including the foundations system that will have design packages prepared for IQRPE review. CH2M HILL is providing the IQRPE with design review packages as AMEC completes the design.

As a basis for the IQRPE certification, a review is performed on a final version of the document "Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package", RPP-24544 as prepared by AMEC and reviewed and approved by CH2M HILL. Each design review package includes a body of text that explains the purpose and scope of the DBVS and describes the overall

process as well as the specific system addressed in the design package. Included as supporting information (appendices) are calculations, site maps, drawings, sketches, piping and instrumentation drawings (P&ID), process flow diagrams (PFD), waste characteristics, technical specifications for materials and equipment, and miscellaneous supporting data. Each design review package will be a revision of the RPP-24544 specific to the system addressed in the package. CH2M HILL is not requiring AMEC to seal/stamp final design documents per WAC standards for any DBVS work, other than the Site Improvements work (foundations and site work). Documents such as drawings, calculations, and specifications included in the design review package that are marked as final and have signatures for the preparer, checker, and approver, will be reviewed by the IQRPE as a complete document. All other documents will be reviewed as preliminary or supportive information.

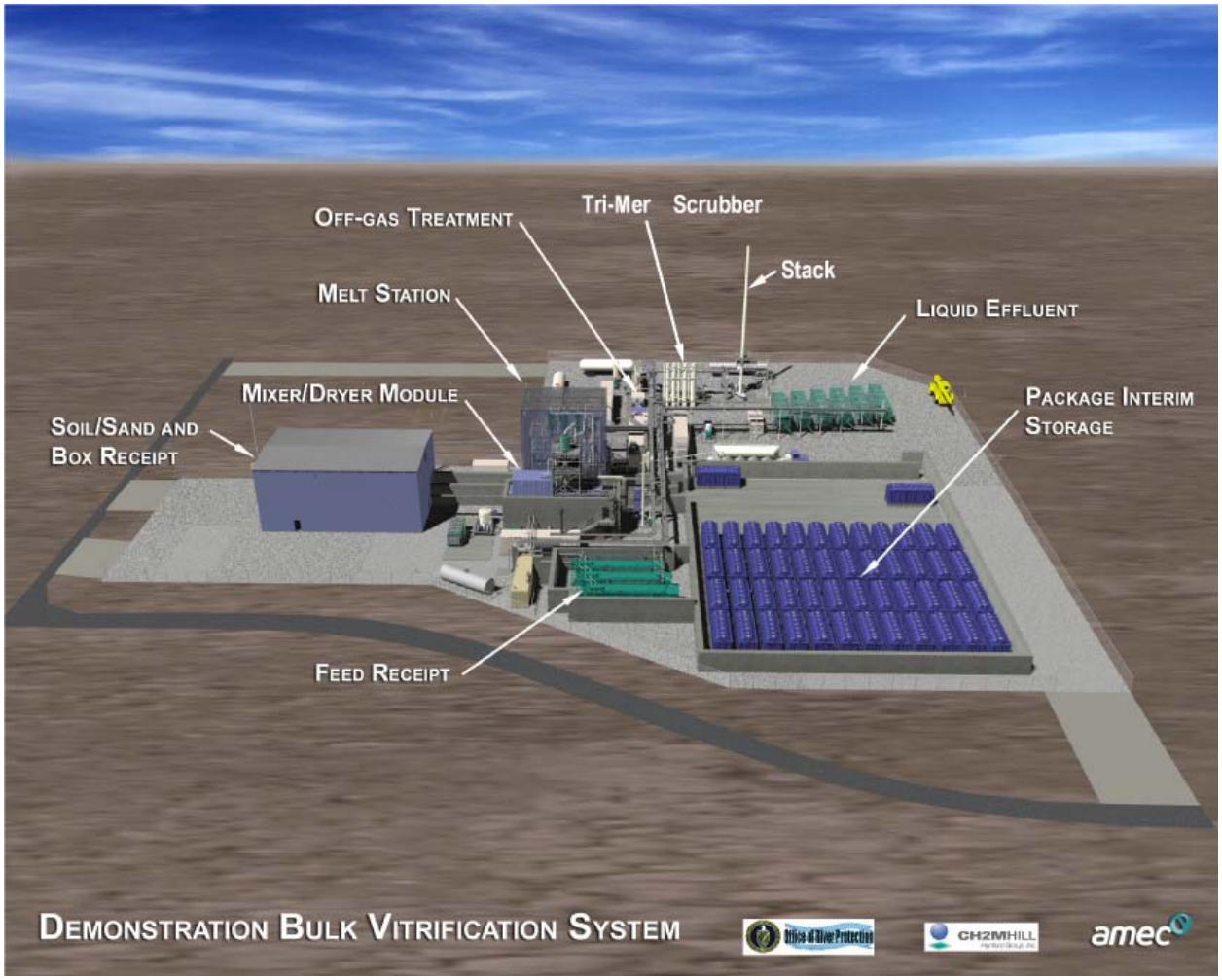


Figure 1. Demonstration Bulk Vitrification System Site Three-Dimensional View

Preliminary design data was submitted and reviewed by the IQRPE reviewer as part of this certification, but only in an effort to familiarize the reviewer with the design until receipt of the final version.

The second system identified for IQRPE design review is the Waste Dryer System, Section 2.2 of RPP-24544, Rev. C, hereafter referred to as Design Package 2.2. The primary functions of the Waste Dryer System are to:

- Receive waste for processing from the liquid waste staging tanks via the waste transfer pump skid,
- Mix liquid waste with process additives, to be added after the waste is mixed with the clean soil and dried(clean soil, zirconium oxide, and boron oxide) in a steam jacketed dryer,
- Evaporate water from the mixture using heat provided by a steam supply system which provides steam to the dryer steam jacket,
- Process gases from the dryer through a condenser to collect water and other species, (5) processes the condensate to the secondary waste system,
- Vent non-condensable gases to the Offgas Treatment System (OGTS), and
- Transfer dried waste mixture to the In-Container Vitrification (ICV) System via the Dried Waste Handling System for vitrification.

The following systems interface with the Waste Dryer System but are outside the scope of the Waste Dryer System and are not included in the scope of this IQRPE review:

- Compressed air and instrument air systems
- Filtered water system, Waste sampling
- Waste transfer system
- Liquid waste staging system
- Process Additives System (provides soil, zirconium oxide and boron oxide to the dryer),
- Dried waste handling system (transfers the dried waste from the dryer to the ICV System)
- OGTS (treats vented gases from the dryer before emission to the environment).

1.3 Waste Dryer System Design Overview

This certification of the Waste Dryer System is based on the information presented in Design Package 2.2. The design package includes multiple calculations, specifications, and drawings, as listed in Attachment A, *IQRPE Disposition of Reviewed Calculations, Specifications and Drawings.* TGS is providing one IQRPE design review report for the Waste Dryer System. Figure 2 shows interfaces between the Dryer and Condensate recovery system and other interfacing systems.

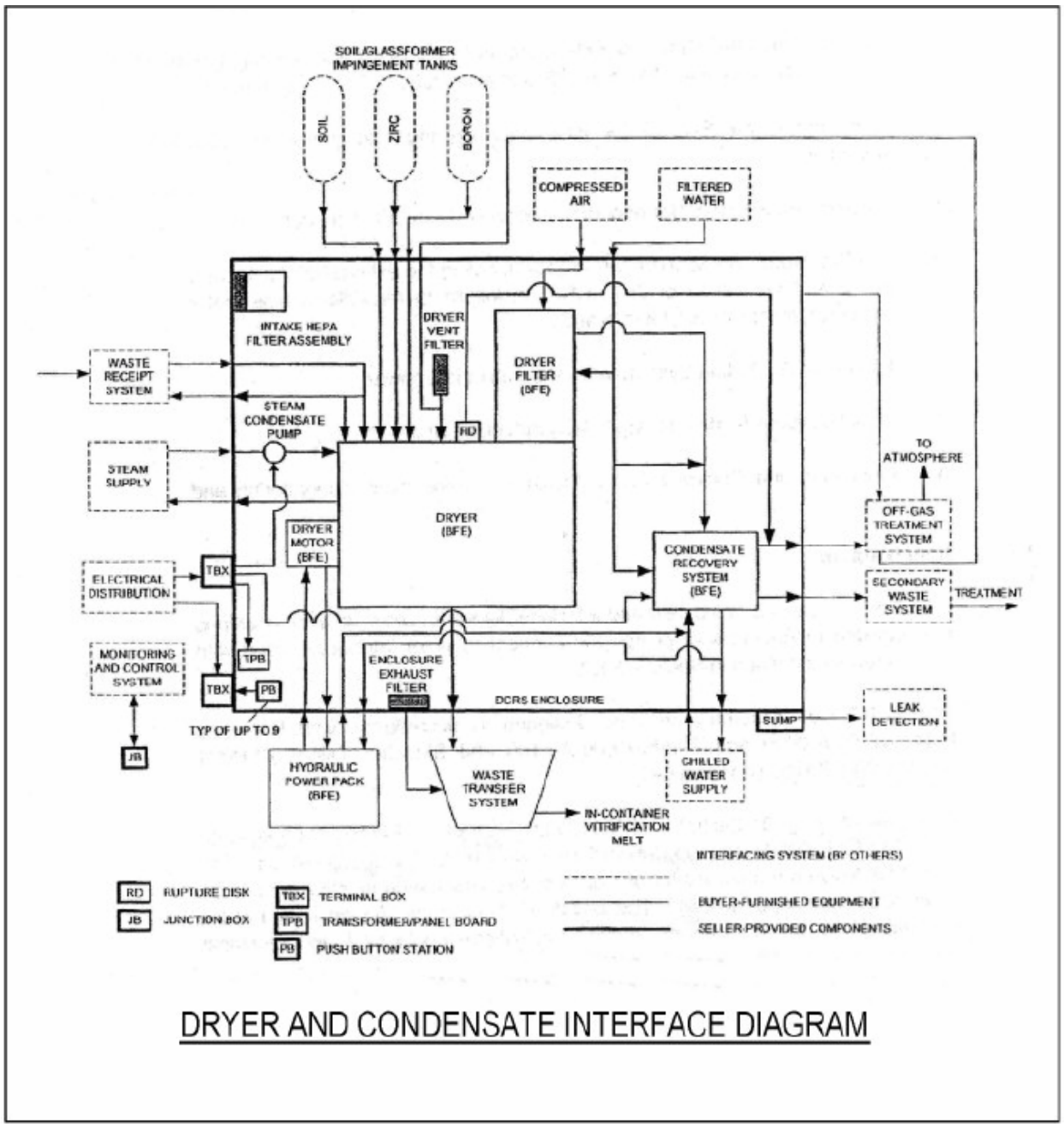


Figure 2 Dryer and Condensate Interface Diagram

The Waste Dryer System includes the following major components:

- Waste Dryer, Dryer Enclosure and HVAC units, and Condensate Recovery System (Specifications 143643-D-SP-001 and 145579-D-SP-006)
- Dryer Chiller Pump Skid and chiller Unit (Specifications 145579-D-SP-005 and Data Sheet 143643-D-DS-039.1)
- Steam Supply System (Specification 145579-D-SP-007)
- Dryer Support Structure and Piping Systems (Drawings F-145579-00-B-0008 and 0009)

The following subsections outline the major subsystems included as part of the Waste Dryer System. Piping and instrumentation diagrams (P&ID) for these subsystems are shown on the following drawings, contained in Attachment D:

- F-145579-33-A-0100 Bulk Vitrification Waste Dryer System
- F-145579-33-A-0101 Bulk Vitrification Waste Dryer Vacuum System
- F-145579-33-A-0104 Bulk Vitrification Waste Dryer Chilled Water System
- F-145579-33-A-0105 Bulk Vitrification Waste Dryer Steam Supply System

The following P&ID's are included in the Waste Dryer System design review package which interface with, but are not a part of the Waste Dryer System:

- F-145579-31-A-0100 Rev J Bulk Vitrification Clean Soil Handling System
- F-145579-31-A-0101 Bulk Vitrification Glass Formers Handling System
- F-145579-32-A-0100 Bulk Vitrification Waste Transfer Pump System

1.3.1 Dryer and Condensate Recovery System Overview (Specifications 143643-D-SP-001 and 006)

The dryer is designed to receive waste through nozzles located on top of the dryer. Glass-forming additives are added through nozzles on top of the dryer. Heat and vacuum are used to dewater the waste feed/soil mixture. Heat is applied to the dryer wall with a steam jacketed shell heat transfer process using low pressure steam (design 15 psig @ 250F operating). Contents in the Waste Dryer are mixed with rotating plows under a high vacuum (design operating @ 26 in. Hg). The plows are arranged in the dryer such that the waste is mixed by directing waste from the ends of the dryer towards the center. The vacuum facilitates the dewatering process by promoting low temperature evaporation and withdrawal of vapor from the head space (design evaporation temperature @ 140deg F). Calculation 145579-D-CA-003 "Dryer Energy, Steam, and Chilled Water Demand Analysis was reviewed by the IQRPE which calculates energy usage of the dryer unit based on the operational requirements for the melting process for determining sizing of the boiler and chiller.

Evaporated moisture is drawn by the vacuum pump through a sintered metal filter mounted on the Waste Dryer to remove particulates before the vapor reaches the condenser unit. Particulates captured in the sintered metal filter are returned to the dryer drum via back pulsing the filter with compressed air. Condensable gases are captured in the Condensate Recovery System by a condenser cooled with chilled water supplied by the dryer chiller pump and tank skid, which recirculates from the chiller unit and a condensate collection tank. The condensate is periodically pumped from the tank to the secondary waste storage tanks. Non-condensables are transferred from the vacuum pump to the Offgas Treatment System (OGTS).

The dryer, filter and Condensate Recovery System are contained in an enclosure. The enclosure provides secondary containment for both liquid and dried waste. The enclosure is designed to be ventilated via outside air drawn through an inlet HEPA filter. Ventilation air passes through the enclosure flows through the outlet HEPA filter to the negatively pressurized dried waste handling system. This system is further discussed in section 2.2.4, “Secondary Containment Design”.

1.3.2 Dryer Chiller Pump Skid and Chiller Unit Overview (Specification 145579-D-SP-005 and Data Sheet 143643-D-DS-039.1)

The Waste Dryer Off-gas condenser heat exchanger receives cooled 50/50 percent glycol/water mixture from an air-cooled screw liquid chiller unit. The unit is comprised of a chiller compressor, evaporator, economizer and chilled water pump skid. The chiller unit has a design nominal cooling capacity of 230 tons with a design cooling fluid inlet temperature of 70° F and a design exit temperature of 50° F. Circulation of the cooling fluid between chiller unit and the Condensate Recovery System is accomplished using one operating dryer chiller pump (one spare) which receives chilled water from the Chiller Surge Tank. Calculation 145579-D-CA-033 “DBVS Waste Dryer Heating and Cooling Load Calculations” was reviewed by the IQRPE for inputs to the CHVAC Commercial Software calculation output.

1.3.3 Steam Supply System Overview (Specification 145579-D-SP-007)

The steam for the dryer is provided by a packaged Steam Supply system installed in a separate enclosure. The assembled Steam Supply System is comprised of a boiler, blow-down separator, duplex feed system, softener, chemical feed, and associated piping and hoses within the enclosure. A separate diesel fuel tank and fuel delivery system supplies the boiler. The steam supply has a specified operating pressure of 15 psig at a capacity of 1,700,000 Btu/hr.

1.3.4 Dryer Support Structure and Piping Systems Overview

The Dryer and Condensate Recovery system (DCRS) is located on a support structure. Details for the structural steel are provided on Drawings F-145579-00-B-0008 and -00-B-0009. Details for anchoring and installation of the system on the support structure are detailed in the Dryer Support Structure Calculation 145579-B-CA-012, Rev 1, which has also received an independent IQRPE review per section 2.2.1 of this report.

Waste is designed to be transferred between the DCRS and the Waste Receipt System via Hose in Hose Transfer Lines (HIHTLs). Liquid secondary waste is transferred to the Secondary Waste System via HIHTLs. Preliminary routing for lines to and from the DCRS , including those for the

steam supply and chilled water units, are shown on Drawings F-145579-00-P-0005, -00-P-0006, -00-P-0007, -00-P-0010, and -00-P-0011. Typical pipe support details are shown on Drawings F-145579-00-P-0001, 00-P-0002, -00-P-0003, and -00-P-0004.

1.4 Scope of IQRPE Design Assessment

This IQRPE design report number is DR-009. This IQRPE design assessment includes a comprehensive review of the Design Package 2.2 in accordance with the requirements of the DBVS RD&D Permit IV.A.8.b.i through IV.A.8.b.viii, IV.A.8.c.i, and V.I.2.a through V.I.2.f, and V.I.3.a through V.I.3.f. Exceptions are listed in Section 2.2 below. The documents included in this review and the level at which each document was reviewed are summarized in Attachment A.

The following items are not covered by the WAC dangerous waste regulations or the RD&D Permit for the facility, and are therefore outside of the scope of this certification:

- Plant utilities, including instrument and plant air supply lines and electrical power beyond the first upstream valve or uninterruptible power supply systems.
- Structural features not related to hazardous waste secondary containment.
- Architectural features not related to hazardous waste containment.
- Lighting systems.
- System design features related to protection of the system due to vehicular traffic.
- Electrical or signal lines beyond the first upstream field termination box (FTB), motor control center (MCC), or instrument control panel (ICS). Specifications for electrical feed, including wiring, local hand switches, terminations, breakers, and other equipment or instruments located in motor control centers were reviewed. Specifications for instrument cabling and terminations were reviewed only between locally mounted devices and field termination boxes and/or local instrumentation and control panels.
- Radiation monitoring or detection components that may be mounted at various locations throughout the system.
- Verification of functional logic for operation and control of the Waste Dryer System.

The IQRPE has not reviewed the Design Package 2.2 to the following design standards referenced in RPP-17403, “Function and System Design Requirements for the Demonstration Bulk Vitrification System” (see Section 4.0 References) because the Waste Dryer System Design Review Package does not address the following issues contained in RPP-17403:

- RPP-17403, section 3.1.2.1.1.3 and Table 3-3 requirements regarding waste feed radio nuclide properties, including all radioactive and radio nuclide property considerations.
- RPP-17403, section 3.1 requirements for the DBVS that the design:

  - Ensure exposure of plant operating personnel to radioactive process streams (radiation) is as-low as reasonably achievable (ALARA). See also Sections 3.2.4 and 3.3.6.1.1.
  - Minimize the production of secondary waste streams.
  - Ensure that all process byproducts are safe for long-term storage or release into the environment.

- RPP-17403, section 3.3.1.6 requirements for the DBVS that the design include the capability for flushing components for decontamination.
- RPP-17403, section 3.3.6 requirements for the DBVS that the design related to the following:
  - Personnel Safety
  - Fire Protection
  - Non-Radioactive Airborne Emissions (Section 3.3.6.3.4)
  - Radioactive Airborne Emissions (Section 3.3.6.3.6)
- RPP-17403, section 3.3.8 (Decontamination and Deactivation) or Section 3.3.9 (Nuclear Safety) requirements for the DBVS.

Because the 90 percent design of the Waste Dryer System has been developed as a purchase specification, much of the 'design' activities have been designated the responsibility of the equipment vendor or Seller. Therefore, this information will not be available until fabrication of the equipment is underway and will require further IQRPE review as part of the construction certification package. Documentation to be reviewed by the IQRPE for inclusion with the construction certification package includes the deliverables listed in Attachment B.

2.0 DESIGN ASSESSMENT

The Waste Dryer System includes the following major components:

- Dryer and Condensate Recovery System (SP-001 and SP-006)
- Dryer Chiller Pump Skid and Chiller Unit (SP-005 and datasheet 143643-D-DS-039.1)
- Steam Supply System (SP-007)
- Dryer Support Structure (Drawings F-145579-00-B-0008, -0009)

See Figure 3, "Waste Dryer System Three-Dimensional View". Figure 3 shows a three-dimensional representation of these components at the DBVS site. The following subsections identify the basis and methods used to complete this IQRPE design certification.

The IQRPE has segregated the design assessment into subsections of the following categories of concern as presented in the WAC regulations:

- Structural Design Standards
- Waste Compatibility
- Pressure Control
- Secondary Containment
- Ancillary Equipment Design
- Corrosion Assessment

At the end of each subsection the IQRPE may include exceptions to the assessment for a particular part of the design. An IQRPE exception, as defined in this report, represents either a lack of specific information on part of the design that will need to be provided, or exceptions shall be cited in meeting the permit and WAC standards which must be sufficiently addressed in the Final Installation Package.

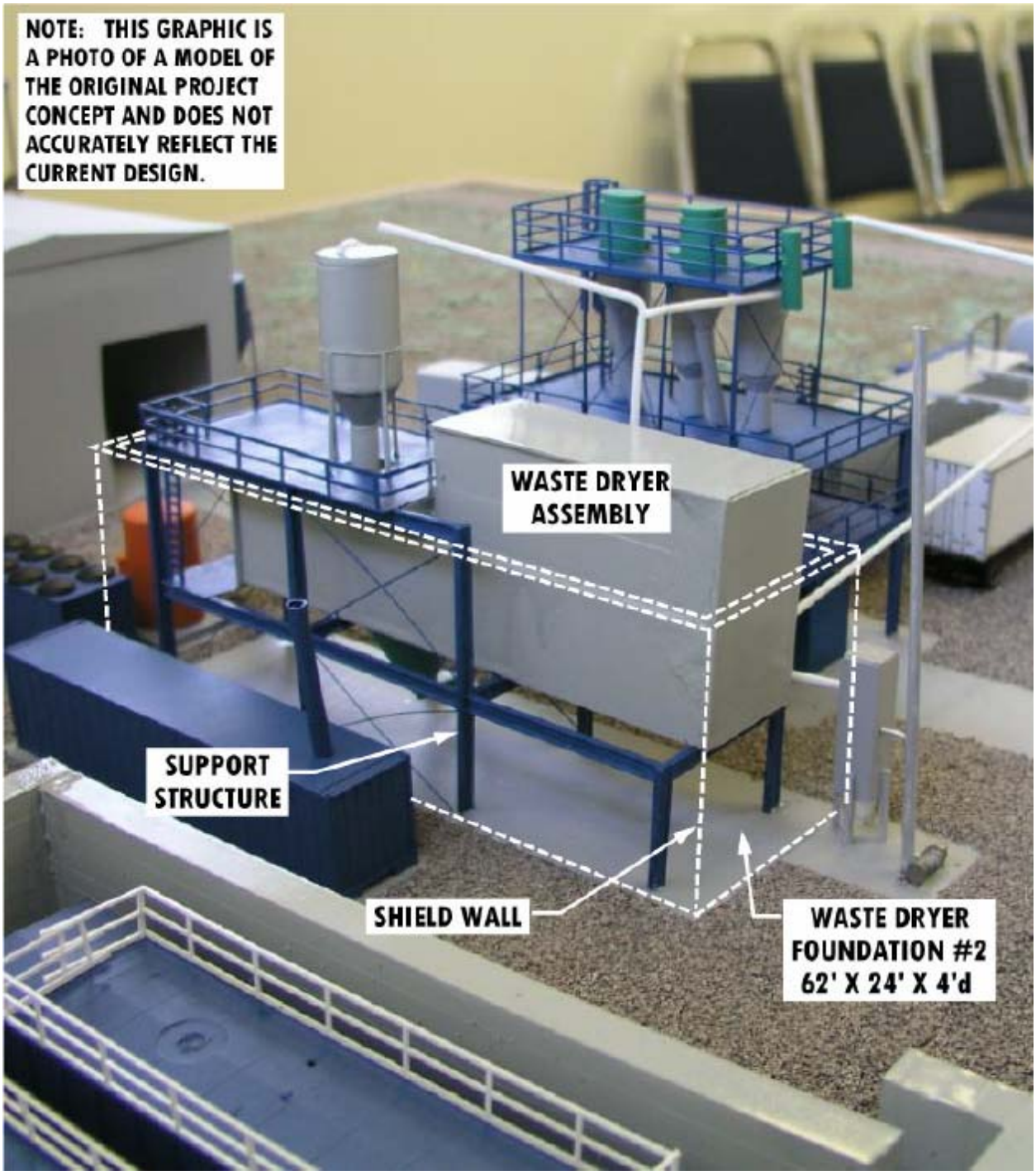


Figure 3 Waste Dryer System Three-Dimensional View

2.1 Codes, Standards and Regulations

The codes, standards, and regulations specifically used during the preparation of this certification are referenced as necessary throughout this report.

A complete list of codes, standards, and regulations that have been incorporated into the Technical Specification packages is included as Attachment C to this report.

The IQRPE concurs with the use of the codes, standards, and regulations that have been designated in the Technical Specifications.

2.2 Basis of Design

The Waste Dryer System is anticipated to operate for a minimum service life of 18 months while handling LAW from Tank S-109. Equipment has been specified with a design life of 5 years. The DCRS is specified to receive batches of liquid salt solution from the Waste Receipt System, mix the liquid salt solution with soil plus additives and evaporate enough water in the dryer under vacuum to provide a suitable dried waste product. The DCRS is also specified to condense the evaporated water and transfer it to the Secondary Waste System and to discharge the dried waste to the dried waste transfer system. Waste processed in the Waste Dryer System combines liquid waste with formulated soils mixtures, as summarized in Tables 1 and 2 below.

Table 1. Waste Dryer System Primary Operating Characteristics

[1] Specification 145579-D-SP-006 Rev 2 Table 3-3

Operating Characteristic	Range
Salt solution content	Nominal 5 Molar Sodium concentration
Waste Chemical Composition	Per Table 3-3 of Specification 143643-D-SP-001 and Data Sheet 143643-D-DS-001.1
Waste supernate liquid density[1]	1.2 to 1.3 g/mlL
Waste viscosity[1]	10 cP Max at 77 F
Waste pH range[1]	8 to 13
Waste temperature range as staged[1]	40 to 150°F

Table 2 Soil and Additives Formulation

(Ref: Spec 143643-D-SP-001, Rev 0 "Dryer and Condensate Recovery System)

Component	Reagent Formula	Mass (g)/kg of Soil Mixture
Hanford Soil (damp)	NA	868
Boron Oxide	B_2O_3	55
Zirconium Oxide	ZrO_2	77

2.2.1 Structural Design Standards

Ecology (1995) requires that an IQRPE certify that the proposed tank system will have a sufficient structural integrity and is acceptable for storing and treating dangerous waste in accordance with WAC 173-303-640(3)(a). This assessment must show that the foundation, structural support, seams, connections, and pressure controls are adequately designed and that the tank system has sufficient structural strength, compatibility with the wastes to be stored or treated, and corrosion protection to ensure that it will not collapse, rupture, or fail in accordance with WAC 173-303-640(3)(a).

The following subsections highlight the IQRPE Structural Design review for Waste Dryer Support Structure as well as each of the major Waste Dryer System subsystems. Specific exceptions to this IQRPE certification report as they relate to the structural review are included as a final subsection.

2.2.1.1 Waste Dryer Support Structure

The IQRPE performed an independent assessment of the Waste Dryer Support Structure-structural calculations, drawings and attachment point loads and reactions. Structural design standards and criteria were reviewed to ensure that they clearly identified and referenced applicable codes, industry standards and recommended practices.

IQRPE independent structural modeling utilized a Rapid Interactive Structural Analysis (RISA) code developed by Los Alamos Technical Associates, Inc. (LATA), which was configured for Waste Dryer System geometric, mathematical and physical structural properties. The approach using the RISA model provided an independent assessment of the AMEC's approach which used a STAAD-Pro structural calculation. The IQRPE review of the waste dryer support structure implemented an independent modeling of the structure in lieu of performing a line-by-line checking of the submitted calculation 145579-B-CA-012, Rev 2. The output was then evaluated for effects on structural members due to structural, equipment and grating weights, as well as resultant seismic and dynamic reaction forces. Where discrepancies existed, the IQRPE structural P.E. conferred with the Seller's Structural P.E. to ensure the differences would be properly rectified, so that the design would satisfy all structural specification and code requirements.

Load conditions were taken from the Seller's calculation 145579-B-CA-012, Rev 2, and compared with framing configurations in drawing F-145579-00-B-0008, Rev F and drawing F-145579-00-B-0009, Rev F. Where discrepancies between drawings and calculations were discovered, the drawings were used as the governing criteria since the drawings reflect the intended fabrication design. AMEC has since revised and corrected calculations to match submitted drawings.

Part of the Design Package 2.2 includes the structural steel supporting structure for the Waste Dryer System, referred to hereinafter as the Waste Dryer Support Structure. It is a major design element of this project and special attention was paid to the review of the calculations for this structure. TGS utilized the structural engineering expertise of subcontractors Parker Messana and Associates (PMA) and Los Alamos Technical Associates (LATA) to help assess this design.

PMA performed a structural IQRPE assessment of the steel support structure using a computer model developed by LATA. The PMA assessment included a review of input and output data from AMEC's STAAD Pro computer model for the steel support structure. The STAAD Pro data was reviewed and compared to the results of an independent RISA-3D structural model prepared by LATA set up using the same parameters used for the STAAD Pro model. Both models were based on AMEC's calculations 145579-B-CA-012 Rev 1, and later updated to reflect the revised calculation 145579-B-CA-102 Rev 2. PMA specifically reviewed the AMEC's manual calculations and seismic calculations, per 1997 UBC code requirements, AISC 9th Edition steel specification requirements. PMA also reviewed AMEC's bracing and connection designs and the AMEC structural Steel Drawings. Hand calculated and verified seismic forces were reviewed and compared to the computer analysis input data and output data. Results of the structural independent review showed that seismic loading was consistent and results of both computer programs were comparable with exceptions listed in applicable "Exceptions" of this report.

PMA found that connection details on the drawings and calculations were incomplete and notified the engineer. The 1997 UBC Section 1633.2.3 requires the engineer to design and detail connections on his documents and not to assign this responsibility to others. This violation was corrected by the Seller. The RISA model indicated several dryer support beams appeared to be overstressed, primarily from load cases including seismic forces. PMA received comments from LATA and contacted the AMEC engineer for his response and resolution. These issues were resolved by the addition of connection details and correction of loading discrepancies.

Figure 4 contains a RISA 3D Sample Output Graphic, which represents a simplification of actual RISA output results.

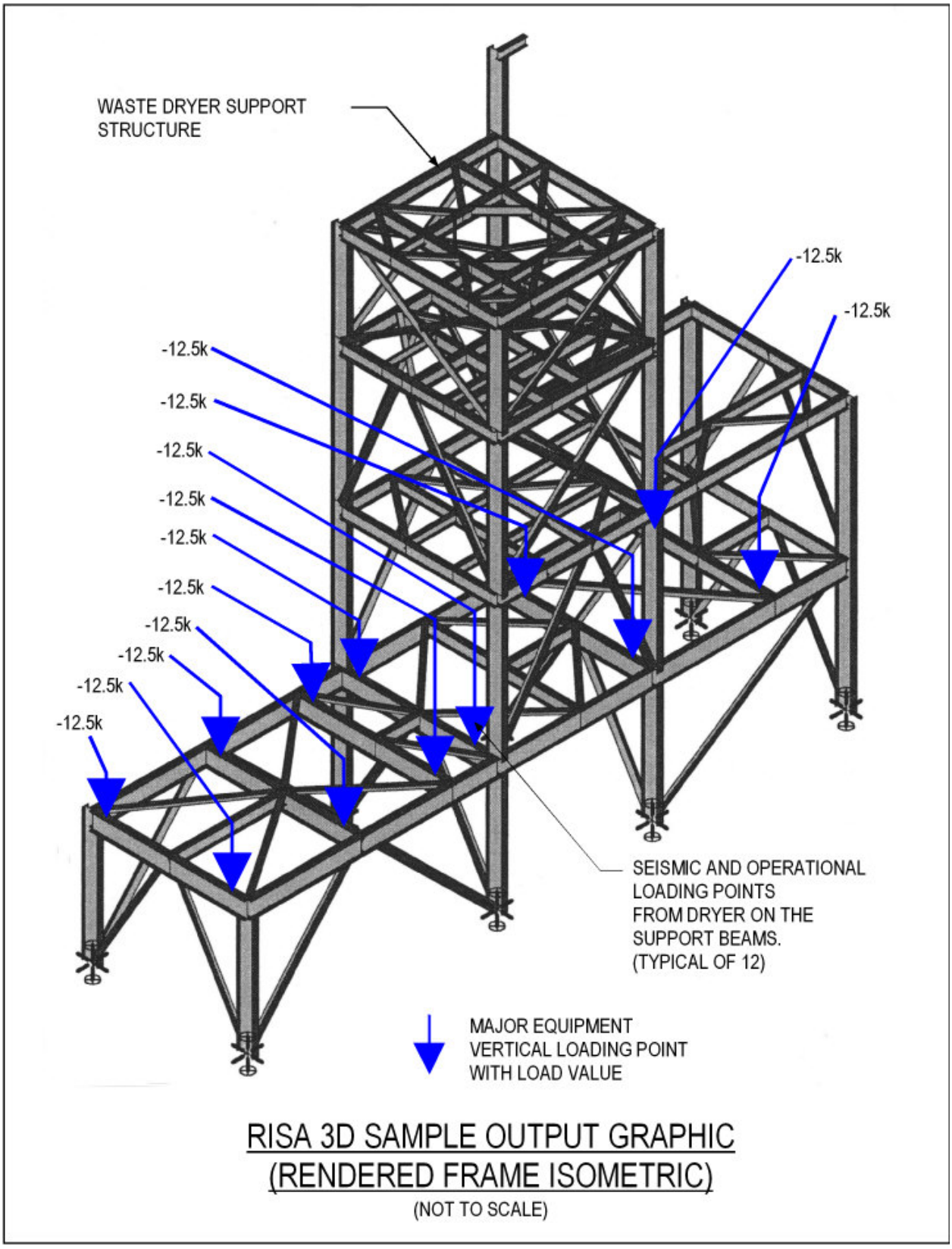


Figure 4 Rapid Interactive Structural Analysis (RISA) Sample Output

2.2.1.1.a Independent Modeling Results and Calculation Review

The magnitudes of the equipment loads were preliminary within the submitted calculation and are preliminary within the independent model since final equipment loads were not available from the vendors. Load distribution and application varied with the independent model and the submitted calculation in two areas. First, uniform live and dead loads were distributed to the secondary framing members within the independent model instead of applied directly to the main framing members as in the submitted calculation. Second, the dryer and associated equipment are contained within an independent enclosure. This enclosure is considered to be capable of carrying all the equipment loads since the enclosure will be lifted into place onto the support structure with the internal equipment installed. Following IQRPE review and comment, the submitted calculation was revised by AMEC to reflect the change from lateral load distribution from the enclosure to 12 locations, corresponding to structural cross framing on the structural and vertical load distribution, to only 4 points. The revised calculation eliminated eccentric moments on secondary members. The independent RISA model has considered both lateral and vertical load distributions to occur at all intersection structural cross framing, where there are 6 intersecting cross members for 12 locations.

Results from the independent model shows that the framing members and arrangements are now adequately designed to support the design loads.

2.2.1.1.b Other Structural Review Considerations

Other structures in the Waste Dryer System including the Dryer Chiller pump skid, Chiller Unit and Steam Supply System structures are not designated to store or treat dangerous waste, and therefore did not receive an IQRPE review in compliance with WAC standards.

Where possible, the IQRPE reviewed the Waste Dryer System report to ensure that the following activities were incorporated into the Technical Specifications as part of the design basis:

- Design parameters used in structural calculations are clearly indicated and labeled on clarifying sketches.

- Seismic considerations, which are appropriate to the seismic risk zone (UBC 1997, Seismic Zone 2B) are accounted for in the structural calculations.

- The foundation underlying the Waste Dryer System will support the load of a full tank plus the secondary containment structure per the requirements of WAC 173-303-640(3)(a)(v)(A). This was certified by the IQRPE as part of DR-002.

- The foundation underlying the Waste Dryer System has been designed to prevent failure due to settlement, compression, and uplift per the requirements of WAC 173-303-640(4)(c)(II). This was certified by the IQRPE as part of DR-002.

- The design plans require that homogeneous, porous, non-corrosive backfill material be placed below and around tank system foundations and underground piping to provide uniform structural support and prevent excessive settlement. This was certified by the IQRPE as part of DR-002.

- The tank systems have been designed to withstand the effects of frost heave per the requirements of WAC 173-303-640(3)(a)(v)(C). This was certified by the IQRPE as part of DR-002.

The following subsections highlight the IQRPE Structural Design Standard review for each of the major Waste Dryer System subsystems, and also identify specific exceptions to this IQRPE certification report as they relate to the structural review.

2.2.1.2 Dryer and Condensate Recovery System (SP-001 and SP-006)

This Technical Specification was reviewed to ensure that provisions for the proper loads, supports, and design basis had been incorporated. With the exception of those issues listed in Section 2.2.1.5 below, the appropriate structural considerations have been made.

2.2.1.3 Dryer Chiller Pump Skid and Chiller Unit (SP-005 and Data Sheet 143643-D-DS-039.1))

This Technical Specification was not reviewed to ensure that provisions for the proper loads, supports, and design basis had been incorporated, since the Chiller Pump Skid and Chiller Unit are not designated to store or treat dangerous waste and do not require IQRPE for review of structural calculations per WAC requirements.

2.2.1.4 Steam Supply System (SP-007)

This Technical Specification was not reviewed to ensure that provisions for the proper loads, supports, and design basis had been incorporated, since the Steam Supply System is not designated to store or treat dangerous waste and does not require IQRPE for review of structural calculations per WAC requirements.

2.2.1.5 Resolved IQRPE Structural Design Concerns

IQRPE Certification exceptions to the structural review are as follows:

1. AMEC calculation 145579-B-CA-012, Rev 1 did not comply with the 1997 UBC Section 2214.6.3.1 requirement for minimum forces in bracing connections. AMEC's use of the ASD compressive buckling strength of the brace as the maximum force that can be transmitted to the brace by the system, was an incorrect interpretation of Section 2214.6.3.1 subsection 3 of the code. The checker noted that revision 2 of the calculations corrected this issue by using subsection 2, omega times the force in the brace due to design seismic forces in combination with gravity loads.

2. AMEC Drawing No. F-145579-00-B-0001, Rev G, Structural Steel, General Notes, 6.1.2, indicated that "The design of the connections shall be the responsibility of the fabricator….". This practice is prohibited by the 1997 UBC Section 1633.2.3 which states that "Connections that resist design seismic forces shall be designed and detailed on the drawings." AMEC has corrected this by designing connections and detailing them on the drawings.

3. AMEC Drawing No. F-145579-00-B-002, Rev D, Figures 1-3 through 1-8, indicated examples and typical connection concepts, but lacked sufficient detail in terms of weld size, weld length, plate thickness, dimensions & bolting to meet the 1997 UBC Section 1633.2.3 requirements. AMEC corrected this on revised drawing F-145579-00-B-002, Rev E.

4. AMEC Drawing No. F-145579-00-B-0009, Rev F, Structural Steel Elevations and Details, indicated the correct "required design force" for the connections using omega times the "seismic service force in the brace" criteria. (220% of the design service load in the brace); however, the referenced forces indicated for the braces are not "required service design forces" and lack the 150% increase required by Section 2214.6.4 of the 1997 Uniform Building Code for chevron bracing. This is potentially confusing, since it is inconsistent with the criteria used for the listed connection forces. It was recommended that brace forces shown on the drawings be revised to "required service design force" similar to the indicated connection forces. AMEC corrected the notation on the revised drawing F-145579-00-B-0009, Rev G.

5. AMEC Drawing F-145579-00-B-0009, Rev F, Structural Steel Elevations and Details, Section D, lacked weld length, weld size, side plate thickness, gusset plate to column weld information and other information necessary to comply with 1997 UBC Section 1633.2.3. AMEC corrected this on the revised drawing F-145579-00-B-0009, Rev G.

6. Although calculations were made to justify the adequacy of a non-building structure using mixed x-bracing, inverted chevron bracing, non-symmetrical bracing and no bracing at all creating a soft story, this type of system and the use of chevron bracing in seismic zones, especially for hazardous classification structures is not generally advised. The 1999 SEAOC blue book comments on this in Section C704.9. It should also be noted that non-building structures typically lack the damping characteristics of buildings, since they lack siding, diaphragms and other components that contribute to energy dissipation. Thus they are generally more susceptible to seismic damage than a similar type building would be. These issues were reviewed with AMEC and it was determined that piping and equipment interferences with bracing determined the type of bracing that was utilized. Since AMEC showed code compliance with their calculations, the design was determined to be adequate.

7. AMEC calculation 145579-B-CA-012, Rev 2 provides the technical basis for the structural design of the DBVS waste dryer support structure along with Drawing No. F-145579-00-B-0008, Rev F and Drawing No. F-145579-00-B-0009, Rev F. In lieu of performing a line-by-line review of the calculation, an independent model was created within RISA 3D Version 5.0d using loading conditions identified within calculation 145579-B-CA-012, Rev 2 and framing arrangements depicted on Drawing No. F-145579-00-B-0008, Rev F and Drawing No. F-145579-00-B-0009, Rev F.

8. AMEC Drawing No. F-145579-00-B-0009, Rev F, showed inconsistent views between Elevation on BL 'Dc', Elevation on BL 'Db', Elevation on BL 'D2', and Elevation on BL 'D1". This was corrected on AMEC Drawing F-145579-00-B-0009, Rev G.

These issues were identified by the IQRPE review and have been resolved.

2.2.1.6 Structural Design Exceptions

There are no exceptions to the IQRPE certification of the structural design assessment.

2.2.2 Waste Compatibility

Ecology (1995) requires that an IQRPE certify that the proposed tank system has been designed of materials compatible with the waste to be stored or treated. Information regarding the waste properties to be stored and treated in the Waste Dryer System is included in the RCRA RD&D Permit, Attachment BB, Section 6.2.3 and Tables 6-2 through 6-6. The Campaign Plans will describe spiking materials and their concentrations, if any, to be added to the waste feed for each ICV. Whenever the potential exists for appreciable increased risk of corroding or causing a leak or rupturing DBVS waste contracting components, an independent qualified corrosion engineer must evaluate the extent of this risk. WAC 173-303-640(3)(a) requires that the proposed materials for the waste dryer system be evaluated for compatibility with the wastes to be stored or treated. WAC 173-303-640(5)(a) requires that the proposed dangerous wastes or treatment reagents may be placed into the proposed waste dryer system without causing the tank or vessel system to rupture, leak, corrode, or otherwise fail.

The IQRPE reviewed the waste property information in conjunction with the design specifications. Properties of the waste stream have been identified in applicable technical specifications for compatibility to the assembled system (see Table 1, Section 2.2 of this report). Waste design compatibility aspects which have been specified include piping and equipment material selection, wall thickness corrosion allowances, enclosure insulation, enclosure freeze protection, and HEPA filtration of potentially contaminated ventilation exhaust and airborne contamination.

The following subsections highlight the IQRPE Waste Compatibility review for each of the major Waste Dryer System subsystems and specific exceptions to this IQRPE certification report as they relate to the Waste Compatibility review.

2.2.2.1 Dryer and Condensate Recovery System (SP-001 and SP-006)

Although specific proposed waste property constituents have been outlined, the degree of corrosion to be expected as a result of the interaction between the waste and proposed construction materials is not a trivial matter. To a large degree, corrosion rates can be expected to be minimal due to the reported pH range (8-13). However, testing will need to be completed to verify this conclusion.

PNNL is conducting bench scale testing to evaluate processing and also to provide observations for corrosion/erosion of materials. It will be imperative to collect corrosion measurements during this testing. Later, during actual system operations it recommended that the use of corrosion coupons be employed to yield valuable information as to the corrosive nature of the process fluid in contact with the proposed containment materials.

The IQRPE concurs that this 90 % design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640(3)(a) and (5)(a), subject to final IQRPE review of results from PNNL materials bench scale testing.

2.2.2.2 Dryer Chiller Pump Skid and Chiller Unit (SP-005 and Data Sheet 143643-D-DS-039.1)

This Technical Specification was not reviewed to ensure that provisions for waste compatibility have been incorporated into the specifications, since the Chiller Pump Skid and Chiller Unit are not designated to store or treat dangerous waste and do not require IQRPE for review of for waste compatibility per WAC requirements.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640.

2.2.2.3 Steam Supply System (SP-007)

This Technical Specification was not reviewed to ensure that provisions for waste compatibility have been incorporated into the specifications, since the Steam Supply System is not designated to store or treat dangerous waste and does not require IQRPE for review of for waste compatibility per WAC requirements.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640.

2.2.2.4 Waste Compatibility Exceptions

IQRPE Certification exceptions to the waste compatibility review are as follows:

- Prior to final acceptance of the proposed construction materials, results of the bench scale testing compatibility with the waste will need to be reviewed by the IQRPE. Corrosion measurements may indicate that the proposed materials are not compatible with the waste products.

Refer to Attachment E, Corrosion Engineering Review, for additional discussion on waste compatability.

2.2.3 Pressure Control System

Ecology (1995) requires that an IQRPE certify that the proposed tank system has been designed with appropriate pressure control systems. Pressure control system information to be submitted by the Seller and reviewed by the IQRPE at a later date is listed in Attachment B.

The following activities have been conducted in the review of the design standards for the Waste Dryer System:

- The Technical Specifications include an acceptable preliminary piping and instrumentation system that will allow for adequate pressure control, per the requirements of WAC 173-303-640(3)(a).

- The Technical Specifications include the following basis for component selection and design basis of pressure control:
  - Vessel operating and design pressures and temperatures
  - Process and relief required flow rates
  - Relief piping size and ratings
  - Pressure ratings of equipment
  - Locations of pressure relief vents and other pressure controls
  - The pressure control system discharge locations

The following subsections highlight the IQRPE Pressure Control System review for each of the major Waste Dryer System subsystems, and also identify specific exceptions to this IQRPE certification report as they relate to the pressure control system review.

2.2.3.1 Dryer and Condensate Recovery System (SP-001 and SP-006)

The Dryer vessel is specified for full vacuum operation. The vessel is to be operated at 26 inches Hg with a maximum of 75 psig external design pressure. The vessel is structurally designed for 5 psig internal pressures, while the steam jacket is specified and stamped per the ASME B&PV Code, Section VIII. A rupture disc on the Dryer vessel is specified at a fixed relief pressure of 5 psig @ and relieves to the dryer offgas system. The rupture disc is also specified to accommodate up to a maximum worst case temperature of 250 deg F. Vendor data for the rupture disc will be evaluated by the IQRPE upon receipt of the Dryer skid design. The 6” relief pipe is adequately sized.

The steam jacket around the pulse back filter is designed to operate at a maximum of 75 psig and is specified to ASME B&PV Code Section VIII. Condensate from the pulse back filter drains through a steam trap to the Waste Dryer Steam Condensate Tank. Presently the pulse back filter steam jacket does not have relief valve protection and this is recommended for consideration be added by the IQRPE and confirmed with the final design.

The Waste Dryer Steam Condensate Tank 33-D74-022 is not shown with overpressure relief protection. Failure of an inlet steam trap would result in application of full steam pressure to the tank. The IQRPE recommends that overpressure protection to this tank be considered to be added and confirmed with the final design.

The Waste Dryer and Condensate Recovery System Enclosure is protected against overpressure due to a pathway for reverse air inherent in the existing design of the ambient air HVAC supply enclosure inlet HEPA filter housing design.

The Waste Dryer Off-gas Condensate Tank 33-D74-015 and Waste Gas Vacuum Off-gas Condenser Tank were evaluated for acceptance per ASME Section VIII, NC-7000 to not having specific overpressure protection. The IQRPE acknowledges that operating and design maximum pressures are low (<20 psig or vacuum), and additional relief protection is not required.

Overpressure of the Waste Gas Dryer vacuum pump did not receive IQRPE review, since the Technical Specification for supply of the Waste Gas Dryer Vacuum Pump shall be a purchase specification that places the responsibility for the final design of the system components on the Seller and was not included in the Waste Dryer System Design Review Package, and is therefore recommended to be confirmed with the final design.

The Waste Dryer and Condensate Recovery System piping and fittings have been specified such that protection from overpressure is maintained. Specific selection of pipe sizes, wall thickness, pipe pressure ratings and material selection corresponding to individual pipe numbers was not reviewed by the IQRPE since of final design piping line class sheets were not available. IQRPE recommends confirmations with the final design.

The Waste Dryer Hydraulic drive system is included in scope for the Dryer System per specification 143643-D-SP-001. Hydraulic tank 33-D74-077 shown on F-145579-33-A-0101 does not show an atmospheric vent nor overpressure protection. Relief protection is required for the hydraulic tank, unless this is designated and shown to be an atmospheric vented tank. Overpressure protection of hydraulic pumps and piping is included in the design.

The Waste Dryer Hydraulic Recirculation pump discharge and return are shown with no throttle valves, thus not requiring overpressure protection. If valves are added anywhere in supply or return piping to the Waste Dryer Motor Case, such as for isolation capabilities of FI-137, then overpressure protection of the hydraulic circuit should be added to the design.

2.2.3.2 Dryer Chiller Pump Skid and Chiller Unit (SP-005 and Data Sheet 143643-D-DS-039.1)

Chilled water overpressure protection at the Waste Dryer Condenser and the Waste Dryer Offgas Condenser did not receive IQRPE review, since condenser data sheets were not included in the Waste Dryer System Design Review Package. Completed Waste Dryer Condenser and the Waste Dryer Offgas Condenser data sheets should be provided and verified by IQRPE with the final design, showing that the condenser design pressure (chilled water side) exceeds the maximum pressure potential available per the chilled water pump shutoff head pressure.

In addition to the above paragraph, this Technical Specification was reviewed to ensure that provisions for waste compatibility have been incorporated into the specifications. The Dryer Chiller Pump Skid and Chiller Unit are not designated to store or treat dangerous waste.

IQRPE review of the Waste Dryer Condenser and the Waste Dryer Offgas Condenser final design data sheets for compliance with the DBVS RD&D Permit and WAC 173-303-640, must be sufficiently addressed in the Final Installation Package.

2.2.3.3 Steam Supply System (SP-007)

This Technical Specification was reviewed to ensure that provisions for pressure control have been incorporated into the specifications. The Steam Supply System is not designated to store or treat dangerous waste.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640.

2.2.3.4 Pressure Control System Exceptions

Technical Specifications prepared for the Waste Dryer System IQRPE/RCRA Design Review Package are purchase specifications that place the responsibility for the final design of the system components on the Seller; thus a complete review of the final pressure control system has not been completed at this time.

Exceptions cited below by the IQRPE in meeting the final design requirements of the DBVS RD&D Permit and WAC 173-303-640, must be sufficiently addressed in the Final Installation Package.

- Pressure relief protection should be added to the compressed air accumulator which feeds the pulse back filter. The upstream mechanical pressure control valve (PCV) does not constitute adequate pressure protection, since PCV's can fail open, and the accumulator design pressure (58psig) is considerably less than the compressed air discharge pressure (150 psig).

- Waste Dryer Condenser and the Waste Dryer Offgas Condenser data sheets should be verified when vendor information is available, to show that these condenser design pressures exceed the maximum chilled water pump shutoff head pressure.

- Completed Waste Dryer Condenser and the Waste Dryer Offgas Condenser data sheets should be provided as part of the installation assessment report, and verified by IQRPE with the final design, showing that these condenser design pressures (chilled water side) exceed the maximum chilled water pump shutoff head pressure.

2.2.4 Secondary Containment System

Ecology (1995) requires that an IQRPE certify that the proposed tank system has been designed with appropriate secondary containment system. Secondary containment for tank systems that store, accumulate, or treat dangerous waste must be designed and installed to meet the requirements of WAC 170-303-640(4)(b). A review of the secondary containment system is normally part of the IQRPE review. Because the Technical Specifications prepared for the Waste Dryer System IQRPE/RCRA Design Review Package are purchase specifications that place the responsibility for the final design of the system components on the Seller, a complete review of the secondary containment system has not been completed.

Secondary containment system information to be submitted by the Seller and reviewed by the IQRPE at a later date is listed in Attachment B.

The following has been considered in the review of the design standards for the Waste Dryer System:

- The system is designed to prevent any migration of wastes or accumulated liquid out of the secondary containment system to the soil, groundwater, or surface water at any time during the use of the tank system.

- The system is capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

- The system is specified of materials that are compatible with the wastes to be placed in the tank system.

- The system has been specified to have sufficient strength to withstand stresses due to static head during a release, pressure gradients, climatic conditions, nearby vehicle traffic, and other stresses resulting from daily operations.

- The system will be placed on a foundation or base that will support the secondary containment system, provide resistance to pressure gradients above and below the system and prevent failure due to excessive settlement, compression, or uplift.

- The system will be provided with a leak detection system that will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within 24 hours (or at the earliest practicable time if the owner or operator can demonstrate to Ecology that existing leak detection technologies or site conditions will not allow detection of a release within 24 hours.)

- The system will be sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation.

The following subsections highlight the IQRPE Secondary Containment System review for each of the major Waste Dryer System subsystems and specific exceptions to this IQRPE certification report as they relate to the secondary containment system review.

2.2.4.1 Dryer and Condensate Recovery System (SP-001 and SP-006)

The Waste Dryer is specified to contain seals designed to preclude leakage of contaminated materials. Included are three installed spare seals, a secondary sealed enclosure built around the dryer shaft seal to contain any potential leak; a gravity drain through a drain line; and seals in potential contact with liquid salt-solution specified for compatibility with the liquid salt-solution properties as specified.

The DCRS skid assembly confinement system (enclosure) is specified to provide secondary confinement for the dryer, sintered metal filter, and condensate recovery skid. The DCRS enclosure is also specified to provide a leak detector sump so the leak detector can sense a minimal amount of liquid waste “in the unlikely event of a leak”. The sump is specified to have a pump out port that is valved and capped or plugged for removal of any liquid contained in the DCRS skid assembly. The DBVS detectable leak volume for the Waste Dryer system is calculated in Calculation 145579-D-CA-030 and was reviewed by the IQRPE. The DCRS enclosure floor is specified with a stainless steel floor pan, extending to the walls of the DCRS container assembly, and to a height enabling the pan to hold 8 inches of water. The floor pan seams are specified to be seal welded and water tight,

or the floor and floor pan may be one in the same. The enclosure is specified to meet requirements of Series 1 freight containers in accordance with applicable ISO standards, designed to contain leakage. Enclosure drainage is specified to drain from walls to the floor to a floor sump via a floor drain as shown on drawing DBVS-SK-M109.

The enclosure personnel access door has been specified as elastomeric-gasket sealed, leak-tight metal marine-type personnel door. Enclosure inlet and outlet piping connections have been specified to mate with HIHTL connections as shown on drawings DBVS-SK-M103 and 109. The enclosure has been specified to air leak test acceptance criteria in accordance with ISO 1496-2. The enclosure lid is specified to be gasketed with a continuous sealing surface between the lid or module contact surfaces, designed to be assembled without detrimentally affecting the sealing surface. Interior walls, doors and ceiling of the enclosure are specified to be lined with 300 series stainless steel sheeting with seams designed to prevent leakage into the walls, designed to accept decontamination sprays.

The Waste Dryer System enclosure is designed to be ventilated with outside air drawn through an inlet HEPA filter, passing through the enclosure and flowing out the outlet HEPA filter to a negatively pressurized dried waste handling system.

The inlet HEPA filter to the Enclosure is also not intended for reverse flow. Thus if the enclosure becomes over-pressurized, it is postulated that the barrier of the inlet HEPA filter could possibly be breached to the environment, however, a search of the WAC indicates this failure would not result in loss of secondary containment. Sources of positive pressure in the Enclosure include the steam and compressed air systems..

Specification 006 describes butterfly valves used to balance the enclosure outlet HEPA filter air flow, using a manual preset damper. Calculation CA-033 requires a 650 cfm air flow to maintain an internal enclosure temperature not to exceed 115 deg F. Actual ventilation air flow rate depends on the setting of the manual HEPA dampers as well as a fluctuating exhaust duct system resistance caused from variable flows of Waste Dryer material processed through the solids chute connected with the HVAC. Thus accurately controlling cooling air flow through Dryer Enclosure equipment spaces is susceptible to poor air flow control, and thus poor air temperature control. This is design approach is not recommended for the following reasons:

- Inability to accurately control HEPA exhaust air flows and temperatures.
- Connecting a ventilation system to a contaminated process solids stream that has the potential for off-normal reverse flow pressure transient of contaminated materials or dust, possibly breaching the secondary confinement HEPA confinement barrier through a HEPA filter that is not designed for back flow prevention.
- Difficulty in adjusting manual balancing dampers located in a normally sealed secondary confinement cubicle. Variable solids flow in the Waste Dryer outlet chute would require variable adjustments of HVAC air flows, which cannot be accomplished using pre-set manual dampers.
- HEPA air flow exhaust into the negatively pressurized Waste Dryer discharge chute compromises the operational ability to increase negative suction pressures to enhance movement of contaminated Dryer waste solids, which may become necessary.

Because the Technical Specifications prepared for the Waste Dryer System IQRPE/RCRA Design Review Package are purchase specifications that place the responsibility for the final design of the system components on the Seller, a complete review of the secondary containment system has not been completed.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640; with the exception of items noted above, which must be sufficiently addressed in the Final Installation Package.

2.2.4.2 Dryer Chiller Pump Skid and Chiller Unit (SP-005 and Data Sheet 143643-D-DS-039.1)

These Technical Specifications were reviewed to ensure that provisions for secondary containment have been incorporated into the specifications. The Dryer Chiller Pump Skid and Chiller Unit are not designated to store or treat dangerous waste.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640.

2.2.4.3 Steam Supply System (SP-007)

This Technical Specification was reviewed to ensure that provisions for secondary containment have been incorporated into the specifications. The Steam Supply System is not designated to store or treat dangerous waste.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640.

2.2.4.4 Secondary Containment System Exceptions

Because the Technical Specifications prepared for the Waste Dryer System IQRPE/RCRA Design Review Package are purchase specifications that place the responsibility for the final design of the system components on the Seller, a complete review of the secondary containment system has not been completed.

The IQRPE concurs that this design basis meets the requirements of the DBVS RD&D Permit and WAC 173-303-640; with the exception of items noted below, which must be sufficiently addressed in the Final Installation Package.

1. The waste dryer system receives waste for processing from the liquid waste staging tanks via the waste transfer pump skid. P&ID F-147779-33-A-0100 Bulk Vitrification Waste Dryer shows a sump instrumented with liquid level alarm. The liquid waste line is a Hose-In-Hose-Transfer-Line (HIHTL) from the staging tanks via the transfer pump skid. If a leak occurs in the liquid waste line inside the waste dryer enclosure, there are no overfill prevention controls or devices as required “at a minimum” in WAC 173-303-640(5)(b) to prevent overfill or spills. The current design of a leak detector activating an alarm annunciating in the control trailer, places reliance on control operator action to shut down the waste transfer pump to avoid sump overflow. “Operator action” is not

described as included “at a minimum” subparagraphs (i), (ii), (iii) of WAC 173-303-640(5)(b) as means of minimum controls to prevent spills.

2. Design features for prevention of contamination of sealing liquid for the small tank for the liquid ring vacuum pump should be addressed. This tank 33-D74-033 is being added to the RD&D permit table IV.1 based on comments from Ecology. It will be managed as a RCRA-regulated tank. Compliance of the tank with requirements and confirmation of the above, will be verified by the IQRPE during the installation assessment.

    a. The IQRPE review did not specifically review radiation monitors, however, an interlock from RIT-019 (or possible future fixed head air sampler) shown on P&ID F-145579-33-A-0100 to the liquid waste staging tank system could possibly mitigate a leak into the waste dryer system enclosure.

    b. The Enclosure HVAC design presents a strong potential for lack of adequate cooling flow and temperature control of the Waste Dryer and Condensate System Enclosure during hot summer conditions. Environmental upper operating limits of equipment and instrumentation inside the enclosure may be challenged. Enclosure cooling is dependent upon the operating status of downstream valves, filters and vacuum pump in the dried waste receiver system.

2.2.5 Ancillary Equipment Design

Ecology (1995) requires that an IQRPE certify that the proposed tank system has been designed with appropriate ancillary equipment (piping, fittings, flanges, valves and pumps) in accordance with the requirements of WAC 170-303-640(3)(f) and (4)(f). A review of the ancillary equipment design is normally part of the IQRPE review. Because the Technical Specifications prepared for the Waste Dryer System IQRPE/RCRA Design Review Package are purchase specifications that place responsibility for the final ancillary configurations and the purchase of all piping, fittings, flanges, valves, pumps, instrumentation, valves, and electronics on the Seller, a complete review of the ancillary equipment design cannot be completed until final 100% design information is available for IQRPE review.

Ancillary equipment design information to be submitted by the Seller and reviewed by the IQRPE at a later date is listed in Attachment B.

The following observations were made during the review of ancillary equipment design standards for the Waste Dryer System:

- Ancillary equipment inside Dryer System secondary containment cannot be visually inspected for leaks on a daily basis.

- Secondary containment has been provided for flanges, joints, and valves and other connections regardless of whether or not they are welded to the piping and visually inspected for leaks on a daily basis.

- Secondary containment has been provided where pumps and valves transfer dangerous wastes between tanks regardless of whether they are seamless and can be visually inspected on a daily basis.

- Tank system ancillary equipment is designed to be supported and protected against damage and excessive stress due to excessive settlement, vibration, expansion or contraction. (Note that equipment to be supplied by the Seller is not yet available for IQRPE review).

- Overfill prevention equipment (includes automatic shutoff controls, high liquid level sensing and high level alarms) has been specified, to warn the operator and/or to shutdown transfer pumps when tank system capacity is reached.

The following subsections highlight the IQRPE Ancillary Equipment Design review as applied to the specifications, P&IDs, and data sheets; and also identifies specific exceptions to this IQRPE certification report as they relate to the ancillary equipment design review.

2.2.5.1 P&ID Review

All P&IDs were reviewed for the following basic considerations:

- Appropriate location of pressure, temperature, and flow sensing equipment.
- Necessary piping, valve, and instrumentation labeling.
- Proper positioning of instrumentation to prevent undue influence from upstream equipment.
- Necessary isolation valves to allow instrumentation maintenance.
- Identification of preliminary interlocks.
- Designation of valves as fail-open or fail-close.
- Location of check valves or back-flow preventers.
- General designation of appropriate alarms and recorded information.
- Overpressure protection

2.2.5.2 Data Sheet Review

Data sheets are generally incomplete or missing and are required for the 100% IQRPE design review. This review shall include:

- Appropriate materials of construction

- Appropriate functionality

- Hazard classification requirements

2.2.5.3 Instrument Loop Diagram Review

IQRPE review of instrument loop diagrams included identification of the appropriate wiring and terminations at the local instruments, junction boxes, termination panels, and MCS.

2.2.5.4 Ancillary Equipment Exceptions

Because the Technical Specifications prepared for the Waste Dryer System IQRPE/RCRA Design Review Package are purchase specifications that place the responsibility for the final design of the system components on the Seller, a complete review of the secondary containment system has not been completed.

No ancillary equipment exceptions were cited by the IQRPE in meeting the final design requirements of the DBVS RD&D Permit and WAC 173-303-640.

2.2.6 Corrosion Assessment

Ecology (1995) requires that an IQRPE certify that the proposed tank system has been designed of materials compatible with the waste to be stored or treated. Information regarding the waste properties to be stored and treated in the Waste Dryer System is included in Technical Specification 145579-D-SP-006 *Dryer and Condensate Recovery System Skid* Tables 3-3 and 3-4 and also in the RCRA RD&D Permit, Attachment BB, Section 6.2.3 and Tables 6-2 through 6-6.

The IQRPE reviewed the waste property information in conjunction with the design specifications. Properties of the waste stream have been identified in applicable technical specifications for compatibility to the assembled system (see Table 1, Section 2.2 of this report). Waste design compatibility aspects which have been specified include piping and equipment material selection, wall thickness corrosion allowances, enclosure insulation, enclosure freeze protection, and HEPA filtration of potentially contaminated ventilation exhaust and airborne contamination.

Although specific proposed waste property constituents have been outlined, the degree of corrosion to be expected as a result of the interaction between the waste and proposed construction materials is not a trivial matter. To a large degree, corrosion rates can be expected to be minimal due to the reported pH range (8-13), however, testing will need to be completed to verify this conclusion.

The following subsections highlight the IQRPE Waste Compatibility review for each of the major Waste Dryer System subsystems and specific exceptions to this IQRPE certification report as they relate to the Waste Compatibility review.

2.2.6.1 Dryer and Condensate Recovery System (SP-001 and SP-006)

In accordance with Technical Specifications 143643-D-SP-001 Rev. 0 Dryer and Condensate Recovery System and 145579-D-SP-006 Dryer and Condensate Recovery System Skid, the following precautions have been made to minimize instances of a corrosion related failure and subsequent release of waste product:

1. The use of stainless steel and coated carbon steel materials.

2. Corrosion allowances for the specified materials, including additional wall thickness for metals in contact with the waste solution.

3. Maximum 5 year system design life.

4. Bench scale dryer testing to be performed by the Pacific Northwest National Laboratory in support of the DBVS.

As part of the bench scale testing, it is imperative that corrosion related data is collected concerning the interaction of the waste products and proposed construction materials. Although waste characteristics have been presented (Specification 145579-D-SP-006 Table 3-3) including range of fluid pH and temperatures, actual corrosion rates will need to be quantified as part of the testing process.

As currently specified, protective coating information including material selection, surface preparation, environmental controls, application procedures, and inspection requirements have been left to the discretion of the Seller. This information is to be provided to the Buyer for review and approval prior to fabrication; however, for materials in contact with the waste fluid, project specific coating specifications should be developed and issued with the design package. This will ensure that the protective coatings will be compatible with the materials and environments to which they are exposed. In addition, provisions should be made for 3rd party coating inspection to be completed.

2.2.6.2 **Steam Supply System** (SP-007)

The portion of the Steam Supply System requiring corrosion control consideration in accordance with WAC-173-303-640 includes the diesel fuel tank.

The diesel fuel tank (33-D74-063, drawing F-145579-00-D-0028) used to supply fuel to the boiler system will be located above grade. A properly specified coating system should be applied to the exterior of the tank to provide a degree of protection against atmospheric corrosion. If the tank is to be used for more than five years, consideration should be given to providing cathodic protection to the tank surfaces in contact with the support pad.

2.2.6.3 **Dryer Chiller Pump Skid and Chiller Unit** (SP-005 and Data Sheet 143643-D-DS-039.1)

Specification 145579-D-SP-005 describes the requirements of the Dryer Chiller Pump Skid. The components associated with this portion of the Waste Dryer System are not subject to the requirements of WAC 173-303-640 in accordance with Waste Compatibility.

Additional corrosion review comments concerning DBVS Waste Dryer System are included as Attachment E, “Corrosion Engineering Review”.

2.2.6.4 **Corrosion Assessment Exceptions**

The following observations have been made in the review of the design standards for the Waste Dryer System:

1. Prior to final acceptance of the proposed construction materials, results of the bench scale testing will need to be reviewed. Corrosion measurements may indicate that the proposed materials are not compatible with the waste products.

2. The final design should provide for the installation of corrosion coupons installed directly into the waste product stream at appropriate locations. This will provide information as to the corrosion resistance of various alloy materials to the waste fluid.

3. Coating specifications should be developed for external surfaces of materials which will be in contact with the waste products.

4. 3rd party coating inspection should be completed at specific hold points as described in the coating specifications.

2.2.7 Recommended Inspection Schedule

Waste Dryer System inspections as listed below are recommended during construction and assembly of the Waste Dryer System before it is placed into operation.

2.2.7.1 Construction Inspections

Adequate tank and system design will not necessarily ensure dangerous waste system installation. "Guidance for Assessing and certifying Tank Systems that store and treat Dangerous Waste (Ecology Publication 94-114, June 1994) describes "Inspecting Tank System Installations" in Chapter 4. The Waste Dryer System contains systems which receive and process dangerous waste from tanks; therefore this publication is determined applicable to the Waste Dryer System.

The integrity of a tank system is determined to a great extent by the quality of the installation. Disciplined inspections to established acceptance criteria are recommended to be conducted at the site throughout the scheduled construction to verify that specified construction requirements are satisfied in accordance with the approved design specifications, drawings and regulatory requirements. Construction inspections are recommended to be spot checked to ensure due diligence, and are not a substitute for a thorough execution of the Quality Assurance/ Quality Control program. DBVS Construction Inspections should be comprehensive, including civil, structural, mechanical, electrical, controls and instrumentation construction inspections. Accurate records must be kept and recorded in a IQRPE inspectors' database to properly track Inspections, Findings, Resolutions and Acceptance by the IQRPE and Buyer. The IQRPE is recommended to perform inspection walkdowns and coordinate with IQRPE inspectors to inspect and document ongoing and completed construction. Written statements by the IQRPE should be provided, attesting that the Waste Dryer System and interconnecting subsystems have been constructed in accordance with specified requirements, as per WAC 173-303-810 (13)(a).

Before placing Waste Dryer Systems into service, which store or process hazardous waste, the associated equipment skids will be inspected by an IQRPE for structural damage and proper installation. The qualified independent inspector or IQRPE will also review the vendor inspection and testing reports, as they are available. Applicable IQRPE fabrication and construction inspections include the following:

- Evaluation of the welds to verify no cracking or lack of fusion.

- Confirmation that no punctures, scrapes of protective coating, cracks, corrosion, or other structure damage are present.

- Review of “tightness testing” (hydrostatic, leak tests, and secondary confinement enclosure leak tests, duct leakage tests and results) to verify no leaks are present through visual inspection and pressure testing, and that pressure or vacuum meets leak test acceptance criteria specified over the test period.

- Review ductwork pressure tests to the relatively high specified pressure (minus 30” W.G.) requirements to ensure integrity is maintained and damage prevented during testing.

- Review of Construction Acceptance Tests including equipment functional checkout tests, valve actuation tests, electrical continuity tests, valve limit switch tests, motor bumping tests, instrumentation functionality tests, interlock and control circuit loop tests.

- Review of a fully integrated pre-operational acceptance test, conducted by representatives of the Buyer, to verify correct operability of all interlocks, wiring, electrical components, instruments, logic, valves and equipment, for both “normal” and “off-normal” conditions, prior to the start of stimulant.

- Verification of the protection of ancillary equipment against physical damage and stress.

- Critical dimension inspections of the DCRS skid assembly within specified tolerances.

- Review of Factory Acceptance Test procedures and test results prior to shipment, including but not limited to electrical circuits and device operation, proper instrumentation operation, valve actuation checkouts.

- Erection and field assembly of Waste Dryer System.

- Installation of secondary containment enclosure.

- Proper filter installations.

- Installation of cathodic protection systems if applicable.

- Installation inspection that conforms to consensus-recognized standards including the documentation of findings and corrective actions documented in a post-inspection report.

- Visual inspections and filtration testing of HVAC filter housing assemblies in accordance with the requirements of ASME N510 (SP-006).

- Review of approved non-destructive procedures and testing results from the following field construction NDT examinations: visual weld examinations, radiography, liquid dye penetrant tests, ultrasonic inspections.

2.2.7.2 Recommended Inspection Exceptions

IQRPE Certification exceptions to the recommended inspection assessment review are as follows:

- The recommended inspection activities described in this section are based on the design basis operating life, operating conditions, and waste characteristics outlined in the Design Basis

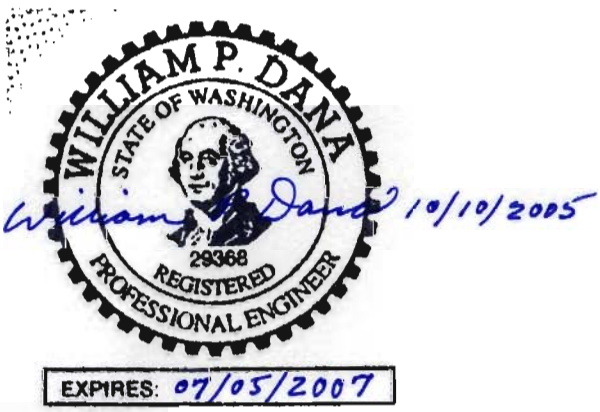
Report. Should any of these parameters change (for example: extended operating life, increased operating temperatures, lower waste Ph), the inspection schedule must be re-evaluated by the IQRPE.

3.0 DESIGN REVIEW ASSESSMENT CERTIFICATIONS

The Waste Dryer System IQRPE/RCRA Design Review Package, RPP-24544, Revision C for System 2.2, has been reviewed by the IQRPE and, with the exceptions listed herein, was assessed to be in compliance with the applicable sections of WAC 173-303-640 and the RD&D Permit for the DBVS as stated in Section 1.4 of this report. These results are based on a review of the applicable codes, standards, and documents. The certifications below are in accordance with the requirements of WAC 173-303-640(2)(b) and 173-303-810(13)(a).

Report Lead IQRPE:

I certify under penalty of the law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.



10/10/2005

Report Reviewed by:

Robert L. Goodman, PE — 10 Oct 05.

Karl M. Walterskirchen, PE — Date

Chief Engineer, TGS

4.0 REFERENCES

WAC 173-303-640 Tank System Used to store or Treat Dangerous Waste, February, 2005

WAC 173-303-810 General Permit Conditions, February, 2005

WA Dept of Ecology Publication 94-114, Guidance for Assessing and Certifying Tank Systems that Store and Treat Dangerous Waste, June 1994

WA Dept of Ecology Publication 95-420 Guidance for Assessing Dangerous Waste Secondary Containment Systems, June 1994

CH2M Hill Hanford Group, Inc. Statement of Work, Requisition 114648, "Independent Qualified Registered Professional Engineer support to Demonstration Bulk Vitrification System Project"

RPP-24544. 2004. Demonstration Bulk Vitrification System IQRPE/RCRA Design Review Package, Revision 0. February 21, 2005

WA Dept of Ecology Permit No. WA 7890008967, Permit for Dangerous and/or Mixed Waste Research, development and Demonstration

RPP-17403. 2004 "Function and System Design Requirements for the Demonstration Bulk Vitrification System." CH2M Hill Hanford Group, Inc. Revision 2.

HNF-SD-GN-ER-501, Rev. 1B, "Natural Phenomena Hazards, Hanford Site, South Central Washington."

RD&D Permit DOE/ORP-2003-23, Rev 1 May 2004 Section 6 "Waste Analysis Plan"

AISC Manual of Steel Construction- Allowable Stress Design, 9th edition

ASHRAE Fundamentals Handbook, 2001

ASME Boiler & Pressure Vessel Code, Section VIII Pressure Vessels, Section IX Welding

ASME B31.3 Process Piping

ASME N510, Testing of Air Treatment Systems

ASNT SNT-TC-1A, Recommended Practice for Nondestructive Testing

ISO 668, 1161, 1496-2, Series 1 Freight containers

UBC 1997 Uniform Building Code

STAAD-Pro structural Software

Rigid Interactive Structural Analysis (RISA) 3D, Rev 5D Software

1999 Structural Engineers Association of California (SEAOC) Recommended Lateral Force Requirements and Commentary

ASTM A999/A 999M, Standard Specification for General Requirements for Alloy and Stainless Steel Pipe, American Society of Testing and Materials, West Conshokocken, Pennsylvania

Nickel Development Institute, Design, Water Factors Affecting Service- Water Piping Materials, NiDI Technical Series No. 10043, Toronto, Ontario

NORSOK Standard L-CR-004, Common Requirements- Piping Fabrication, Installation, Flushing and Testing, Norway

ATTACHMENT A

WASTE DRYER SYSTEM

IQRPE DISPOSITION OF CALCULATIONS, SPECIFICATIONS, AND DRAWINGS

ATTACHMENT A

WASTE DRYER SYSTEM

IQRPE DISPOSITION OF CALCULATIONS, SPECIFICATIONS, AND DRAWINGS

Document Number	Document Title	Comments
Calculations		
145579-B-CA-012 Revision 2 Appendix A2	Waste Dryer Support Structure	This calculation was reviewed and independently modeled and checked. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-B-CA-004 Revision B Appendix A2	Full DVBS Process Mass Balance Conversion	This calculation was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-B-CA-003 Revision D Appendix A2	Dryer Energy, Steam and Chilled Water Demand Analysis	This calculation was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-B-CA-033 Revision A Appendix A2	DBVS Waste Dryer Enclosure Heating and Cooling Load Calculations	This calculation was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-B-CA-030 Revision C Appendix A2	DBVS Detectable Leak Volume for the Waste Dryer System	This calculation was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.

Waste Dryer System Drawings		
Document Number	**Document Title**	**Comments**
B-145579-31-F-0008 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 31-Y-008	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-31-F-0009 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 31-Y-009	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-31-F-0508 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 31-Y-508	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-31-F-0509 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 31-Y-509	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-31-F-0608 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 31-Y-608	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-31-F-0609 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 31-Y-609	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0003 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-F-003	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0004 Revision B (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-Y-004	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0008 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-W-008	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.

Waste Dryer System Drawings		
Document Number	**Document Title**	**Comments**
B-145579-33-F-0010 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 32-Y-010	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0013 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-Y-013	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0018 Revision D (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-L-018	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0033 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-Y-033	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0137 Revision B (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 33-Y-037	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-33-F-0038 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 32-T-202	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
B-145579-32-F-0308 Revision C (Appendix C2)	Bulk Vitrification Instrumentation Loop Diagram 32-L-308	A preliminary review of this drawing was conducted. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. This drawing will need to be revised using Vendor-supplied instrument data during the detailed design.
DBVS-SK-M109 Revision A (Appendix C2)	Bulk Vitrification DCRS General Arrangement	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-B-0001 Revision G (Appendix C2)	Bulk Vitrification Structural Steel General Notes- Sheet 1	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-B-0002 Revision D (Appendix C2)	Bulk Vitrification Structural Steel General Notes- Sheet 2	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.

Waste Dryer System Drawings		
Document Number	**Document Title**	**Comments**
F-145579-00-B-0003 Revision F (Appendix C2)	Bulk Vitrification Structural Steel Typical Details- Sheet 1	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-B-0004 Revision D (Appendix C2)	Bulk Vitrification Structural Steel Typical Details- Sheet 2	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-B-0008 Revision F (Appendix C2)	Bulk Vitrification Dryer Structural Steel plans & Details	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-B-0009 Revision F (Appendix C2)	Bulk Vitrification Dryer Structural Steel plans & Details	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-D-0011 Revision D (Appendix C2)	Bulk Vitrification Waste Receipt & Dryer Area G.A. Plan	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-D-0028 Revision D (Appendix C2)	Bulk Vitrification Area Waste Receipt & Dryer Area Sections- A,B,C, & D	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-D-0029 Revision C (Appendix C2)	Bulk Vitrification Area Waste Receipt & Dryer Area Section- Area Section E	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-D-0030 Revision C (Appendix C2)	Bulk Vitrification Area Waste Receipt & Dryer Area Section- Area Section F	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-D-0031 Revision B	Bulk Vitrification Area Waste Receipt & Dryer Area Section- Area Section G	This drawing was reviewed by the IQRPE and used to independently check structural calculations for the Dryer Support Structure. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.

Waste Dryer System Drawings		
Document Number	**Document Title**	**Comments**
F-145579-00-P-0005 Revision C (Appendix C2)	Bulk Vitrification Dryer Piping Layout	This drawing was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-00-P-0001 Revision C (Appendix C2)	Bulk Vitrification Typical Pipe Support Details Sht 1 of 4	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0002 Revision C (Appendix C2)	Bulk Vitrification Typical Pipe Support Details Sht 2 of 4	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0003 Revision C (Appendix C2)	Bulk Vitrification Typical Pipe Support Details Sht 3 of 4	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0004 Revision C (Appendix C2)	Bulk Vitrification Typical Pipe Support Details Sht 4 of 4	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0005 Revision E (Appendix C2)	Bulk Vitrification Dryer Piping Layout	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0006 Revision D (Appendix C2)	Bulk Vitrification Dryer Effluent Piping Layout	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0007 Revision D (Appendix C2)	Bulk Vitrification Offgas Treatment Piping Layout	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0010 Revision D (Appendix C2)	Bulk Vitrification Dryer Piping Sections	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-P-0011 Revision D (Appendix C2)	Bulk Vitrification Dryer Effluent Piping Section	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
H-14-106789 Revision 1 (Appendix C2)	Bulk Vitrification Civil Site Improvements Plan	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.

Waste Dryer System Drawings		
Document Number	**Document Title**	**Comments**
ECN 722466 Revision 0 (Appendix C2)	DBVS- Electrical Equipment Foundation- Plans & Sections	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing
H-14-106793 Revision 0 (Appendix C2)	Bulk Vitrification Waste Dryer Foundation Plan & Section	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System foundation was reviewed in DR-001.
H-14-106794 Revision 0 (Appendix C2)	Bulk Vitrification Receipt Area Foundations- Plans & Sections	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System foundation was reviewed in DR-001.
F-145579-00-A-0099 Revision G (Appendix D2)	Bulk Vitrification P&ID “Typicals” Legend	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-00-A-0100 Revision K (Appendix D2)	Bulk Vitrification P&ID Symbol Legend	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing..
F-145579-00-A-0102 Revision B (Appendix D2)	Bulk Vitrification Facility/Process Air Distribution P&ID Sht. 1	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-31-A-0100 Revision K (Appendix D2)	Bulk Vitrification Facility Clean Soil Handling System P&ID	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-31-A-0101 Revision E (Appendix D2)	Bulk Vitrification Glass Formers Handling System P&ID	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-32-A-0100 Revision 0B (Appendix D2)	Bulk Vitrification Waste Transfer Pump P&ID	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-33-A-0100 Revision L (Appendix D2)	Bulk Vitrification Waste Dryer P&ID	This drawing was reviewed in its entirety. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-33-A-0101 Revision M (Appendix D2)	Bulk Vitrification Waste Dryer Vacuum P&ID	This drawing was reviewed in its entirety. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.

Waste Dryer System Drawings		
Document Number	**Document Title**	**Comments**
F-145579-33-A-0104 Revision F (Appendix D2)	Bulk Vitrification Waste Dryer Chilled Water System P&ID	This drawing was reviewed in its entirety. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-33-A-0105 Revision F (Appendix D2)	Bulk Vitrification Waste Dryer Steam Supply System P&ID	This drawing was reviewed in its entirety. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
F-145579-33-A-0106 Revision C (Appendix D2)	Bulk Vitrification Waste Feed Dryer to Box P&ID	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-36-A-0099 Revision F (Appendix D2)	Bulk Vitrification Offgas Dust Removal P&ID	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.
F-145579-37-A-0101 Revision 0A (Appendix D2)	Bulk Vitrification Secondary Waste Storage P&ID	This drawing was used for information purposes only. The IQRPE certification for the Waste Dryer System does not address the specific content of this drawing.

Technical Specifications		
Document Number	**Document Title**	**Comments**
145643-D-SP-001 Revision 0 (Appendix G2)	Dryer and Condensate Recovery System	This specification was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-D-DS-039.1 Revision 1 (Appendix G2)	Technical Data Sheet: Air Cooled Screw Liquid Chiller Equipment No.- 33-D58-058	This specification was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-D-SP-005 Revision 1 (Appendix G2)	Dryer Chiller Pump Skid	This specification was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-D-SP-006 Revision 2 (Appendix G2)	Dryer and Condensate Recovery System Skid	This specification was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
145579-D-SP-007 Revision 0 (Appendix G2)	Steam Supply System	This specification was reviewed by the IQRPE. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.

Supporting Information		
Document Number	**Document Title**	**Comments**
Corrosion Review (Appendix H2)	Technical Specifications: A Corrosion Review: *Dryer and Condensate Recovery System (*143643-D-SP-001) and *Dryer and Condensate Recovery System Skid* (145579-D-SP-006)	An IQRPE Corrosion Specialist has performed an assessment of the corrosion resistance of the Waste Dryer System. The assessment included an independent design review with consideration to previous corrosion review comments and responses contained in Appendix H2. The IQRPE corrosion specialist has prepared a signed and stamped corrosion assessment per Attachment E to this report. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report.
Typical Leak Detector Data Sheet (Appendix not identified)	Sample: 33-LSH-018	This data sheet was reviewed in its entirety. Specific IQRPE review activities and any exceptions are described in Section 2.2 of this report. Because the data sheet is preliminary, it will require additional IQRPE review when final.
Process Flow Diagrams (Appendix E)	**MISSING FLOW DIAGRAMS**	**Appendix E Process Flow Diagrams are not contained in the DBVS Waste Dryer System Design Review Package. The flow diagrams are required for the IQRPE 100% final design certification.**

ATTACHMENT B

WASTE DRYER SYSTEM DESIGN DELIVERABLES TO BE REVIEWED WITH THE CONSTRUCTION CERTIFICATION PACKAGE

ATTACHMENT B

WASTE DRYER SYSTEM DESIGN DELIVERABLES TO BE REVIEWED WITH THE CONSTRUCTION CERTIFICATION PACKAGE

Submittal Number	Submittal Title
DRYER AND CONDENSATE RECOVERY SYSTEM	
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Outline drawing including weights and dimensions
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Mechanical shaft seal drawing and any proposed alternatives
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	List of pump materials of construction (with wetted parts noted)
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Test Plan
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Technical brochures on purchased components
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Dryer mass and energy balance calculation
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Equipment dimensional drawings
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Electrical wiring diagrams
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Control wiring diagrams
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Pipe support detail drawings
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Motor specifications and datasheet
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Bill of materials
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	System assembly instructions
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Gearbox maintenance
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Operation and maintenance manuals
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Welding procedures; procedure qualification and welder procedure qualification records
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	AWS CWI certificate
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Insulation system
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Protective coating specifications
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Recommended spare parts and frequency of replacement

Submittal Number	Submittal Title
143643-D-DS-001 Appendix A, Bidder's Drawing & Data Commitments	Final test results

AIR COOLED SCREW LIQUID CHILLER	
143643-D-DS-039.1 Appendix A, Bidder's Drawing & Data Commitments	Completed data sheets
143643-D-DS-039.1 Appendix A, Bidder's Drawing & Data Commitments	Outline drawings and layout drawings indicating weights and dimensions
143643-D-DS-039.1 Appendix A, Bidder's Drawing & Data Commitments	Technical brochures on purchased components
143643-D-DS-039.1 Appendix A, Bidder's Drawing & Data Commitments	Electrical schematics, wiring diagrams and nameplate information
143643-D-DS-039.1 Appendix A, Bidder's Drawing & Data Commitments	Set of installation and maintenance manuals c/w technical literature for all equipment and devices

DRYER CHILLER PUMP SKID	
145579-D-SP-005 Appendix A, Bidder's Drawing & Data Commitments	Completed data sheet
145579-D-SP-005 Appendix A, Bidder's Drawing & Data Commitments	100% Design and Fabrication Package including: Drawings Calculations Completed equipment data sheets Vendor cut sheets/technical brochures
145579-D-SP-005 Appendix A, Bidder's Drawing & Data Commitments	Test plan/Test procedure
145579-D-SP-005 Appendix A, Bidder's Drawing & Data Commitments	System assembly instructions
145579-D-SP-005 Appendix A, Bidder's Drawing & Data Commitments	Operation and maintenance manuals

DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Completed data sheets
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Outline drawing including weights and dimensions
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	List of pump materials of construction (with wetted parts noted)
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Test plan
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Technical brochures on purchased components
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Equipment dimensional drawings
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Electrical wiring diagrams
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Control wiring diagrams
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Pipe support detail drawings

Submittal Number	Submittal Title
DRYER AND CONDENSATE RECOVERY SYSTEM SKID (cont.)	
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Pipe support detail calculations
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	ISO container modification structural calculation
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Motor specs and datasheet
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Bill of matierials
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	System assembly instructions
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Operation and maintenance manuals
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Welding procedures, procedure qualification records, and welder procedure qualification records
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	AWS CWI certificate
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Insulation system
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Protective coating specifications
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	FAT procedures
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Fabrication red line changes
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Final test results
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	Certified test material reports
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	CoC's and MTR's
145579-D-SP-006 Appendix A, Bidder's Drawing & Data Commitments	As built drawings

ATTACHMENT C

CODES, STANDARDS, AND REGULATIONS INCORPORATED INTO TECHNICAL SPECIFICATION PACKAGES

ATTACHMENT C

CODES, STANDARDS, AND REGULATIONS INCORPORATED INTO TECHNICAL SPECIFICATION PACKAGES

10 CFR 830	"Nuclear Safety Management," *Code of Federal Regulations*, as amended.
29 CFR 1910	"Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
40 CFR 264	"Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," subpart J. *Code of Federal Regulations*, as amended.
47 CFR 15	"Radio Frequency Devices," *Code of Federal Regulations*, as amended.
DOE/RL-92-36	*Hanford Site Hoisting and Rigging Manual*, U.S. Department of Energy, Richland, Washington.
AATCC Test Method 27	*Water Resistance: Hydrostatic Pressure Test*, American Association of Textile Chemists and Colorists, Research Triangle Park, North Carolina.
AISC Allowable Stress Design	*Manual of Steel Construction – Allowable Stress Design*, Ninth Edition, American Institute of Steel Construction, Chicago, Illinois.
AISC Load and Resistance Factor Design	*Manual of Steel Construction – Load and Resistance Factor Design.* Third Edition, American Institute of Steel Construction, Chicago, Illinois.
ANSI/ASME B1.20.1	*Pipe Threads, General Purpose (Inch).* American National Standards Institute, New York, New York.
ANSI/AWWA D100	*AWWA Standard for Welded Steel Tanks for Water Storage*, American Water Works Association, Denver, Colorado.
ANSI C63.16	*American National Standard Guide for Electrostatic Discharge Test Methodologies and Criteria for Electronic Equipment*, American National Standards Institute, Washington, D.C.

ANSI FCI 70-2	*Control Valve Seat Leakage,* Fluid Controls Institute, Inc., Cleveland, Ohio.
ANSI/HI 3.1-3.5	*American National Standard for Rotary Pumps for Nomenclature, Definitions, Applications and Operation,* Hydraulic Institute, Parsippany, New Jersey.
ANSI/HI 3.6	*American National Standard for Rotary Pump Tests*, Hydraulic Institute, Parsippany, New Jersey.
ANSI/IESNA RP-7	*Lighting Industrial Facilities,* Illuminating Engineering Society of North America, New York, New York.
ANSI Y14.1	*Drawing Sheet Size and Format*, American National Standards Institute, Inc. New York, New York.
ANSI Y14.5M	*Dimensioning and Tolerancing,* American National Standards Institute, New York, New York.
API 620	*Design and Construction of Large, Welded, Low-Pressure Storage Tank, Tenth Edition,* American Petroleum Institute, Washington, D.C.
ASCE 4-98	*Seismic Analysis of Safety-Related Nuclear Structures,* American Society of Civil Engineers, Reston, Virginia.
ASCE 7-98	*Minimum Design Loads for Buildings and Other Structures,* American Society of Civil Engineers, Reston, Virginia.
ASHRAE Fundamentals Handbook	*2001 ASHRAE Handbook – Fundamentals*, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, Georgia.
ASME B&PV Code Sections VIII and IX	*ASME Boiler and Pressure Vessel Code,* American Society of Mechanical Engineers, New York, New York.
ASME B16.5	*Pipe Flanges and Flanged Fittings,* American Society of Mechanical Engineers, New York, New York.
ASME B16.9	*Factory-Made Wrought Steel Buttwelding Fittings,* American Society of Mechanical Engineers, New York, New York.

ASME B16.11	*Forged Fittings, Socket Welding and Threaded,* American Society of Mechanical Engineers, New York, New York.
ASME B18.2.1	*Square and Hex Bolts and Screws Inch Series,* American Society of Mechanical Engineers, New York, New York.
ASME B18.2.2	*Square and Hex Nuts,* American Society of Mechanical Engineers, New York, New York.
ASME B31.3	*Process Piping,* American Society of Mechanical Engineers, New York, New York.
ASME NQA-1, 1994	*Quality Assurance Program Requirements for Nuclear Facilities,* American Society of Mechanical Engineers, New York, New York.
ASME PCC-1	*Guidelines for Pressure Boundary Bolted Flange Joint Assembly,* American Society of Mechanical Engineers, New York, New York.
ASNT SNT-TC-1A	*Recommended Practice,* American Society of Nondestructive Testing, Columbus, Ohio.
ASTM A36/A36M	*Standard Specification for Carbon Structural Steel, American Society of Testing and Materials,* New York, New York.
ASTM A53/A53M	*Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless,* American Society of Testing and Materials, New York, New York.
ASTM A105/A105M	S*tandard Specification for Carbon Steel Forgings for Piping Applications,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A106	*Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A108	*Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A182/A182M	*Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service*, American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A193/A193M	*Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A194/A194M	*Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service or Both,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A234/A234M	*Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy for Moderate and High Temperature Service,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A240/A240M	*Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A269	*Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service,* American Society of Testing and Materials, New York, New York.
ASTM A276	*Standard Specification for Stainless Steel Bars and Shapes,* American Society of Testing and Materials, New York, New York.
ASTM A307	*Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength,* American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A312/A312M	*Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes,* American Society for Testing and Materials, West Conshohocken, Pennsylvania

ASTM A325	*Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A354	*Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and other Externally Threaded Fasteners,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A403/A403M	*Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings*, American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A480/A480M	*Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A500	*Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A563a	*Standard Specification for Carbon and Alloy Steel Nuts,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM A569	*Standard Specification for Steel, Carbon (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip Commercial,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM C518	*Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM D380	*Standard Test Methods for Rubber Hose*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM D991	*Standard Test Method for Rubber Property-Volume Resistivity of Electrically Conductive and Antistatic Products,* American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM D1621	*Standard Test Method for Compressive Properties of Rigid Cellular Plastics,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM D1622	*Standard Test Method for Apparent Density of Rigid Cellular Plastics,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM D5162	*Standard Practice for Discountability (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates,* American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM E84	*Standard Test Method for Surface Burning Characteristics of Building Materials,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM E96	*Standard Test Methods for Water Vapor Transmission of Materials,* American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM E285	*Standard Test Method for Oxyacetylene Ablation Testing of Thermal Insulation Materials,* American Society for Testing and Materials, West Conshohocken, Pennsylvania.
AWS D1.1/D1.1M	*Structural Welding Code* – Steel, American Welding Society, Miami, Florida
AWS D1.6	*Structural Welding Code* – Stainless Steel, American Welding Society, Miami, Florida.
AWS QC-1	*Standard for AWS Certification of Welding Inspectors,* American Welding Society, Miami, Florida.
HNF-2962	*A List of EMI/EMC Requirements,* Rev. O, Numatec Hanford Corporation for Fluor Daniel Hanford, Inc. Richland, Washington.
HNF-SD-GN-ER-501	*Natural Phenomena Hazards,* Hanford Site, Washington, Revision 1B, Westinghouse Hanford Company, Richland, Washington.

IEC 61000-4-2	*Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test,* International Engineering Consortium, Chicago, Illinois.
IEEE C62.41.1	*IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE C62.41.2	*IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits,* Institute of Electrical and Electronics Engineers, New York, New York
IEEE C37.90.2	*IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 141	*IEEE Recommended Practice for Electric Power Distribution for Industrial Plants,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 142	*IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 242	*IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems,* Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 519	*Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems,* Institute of Electrical and Electronics Engineers, New York, New York.
IESNA HB-9	*IESNA Lighting Handbook,* 9th Edition, Illuminating Engineering Society of North America, New York, New York.
IP-2	The 2003 Hose Handbook, 7th Edition, Rubber Manufacturers of America, Washington, D.C.

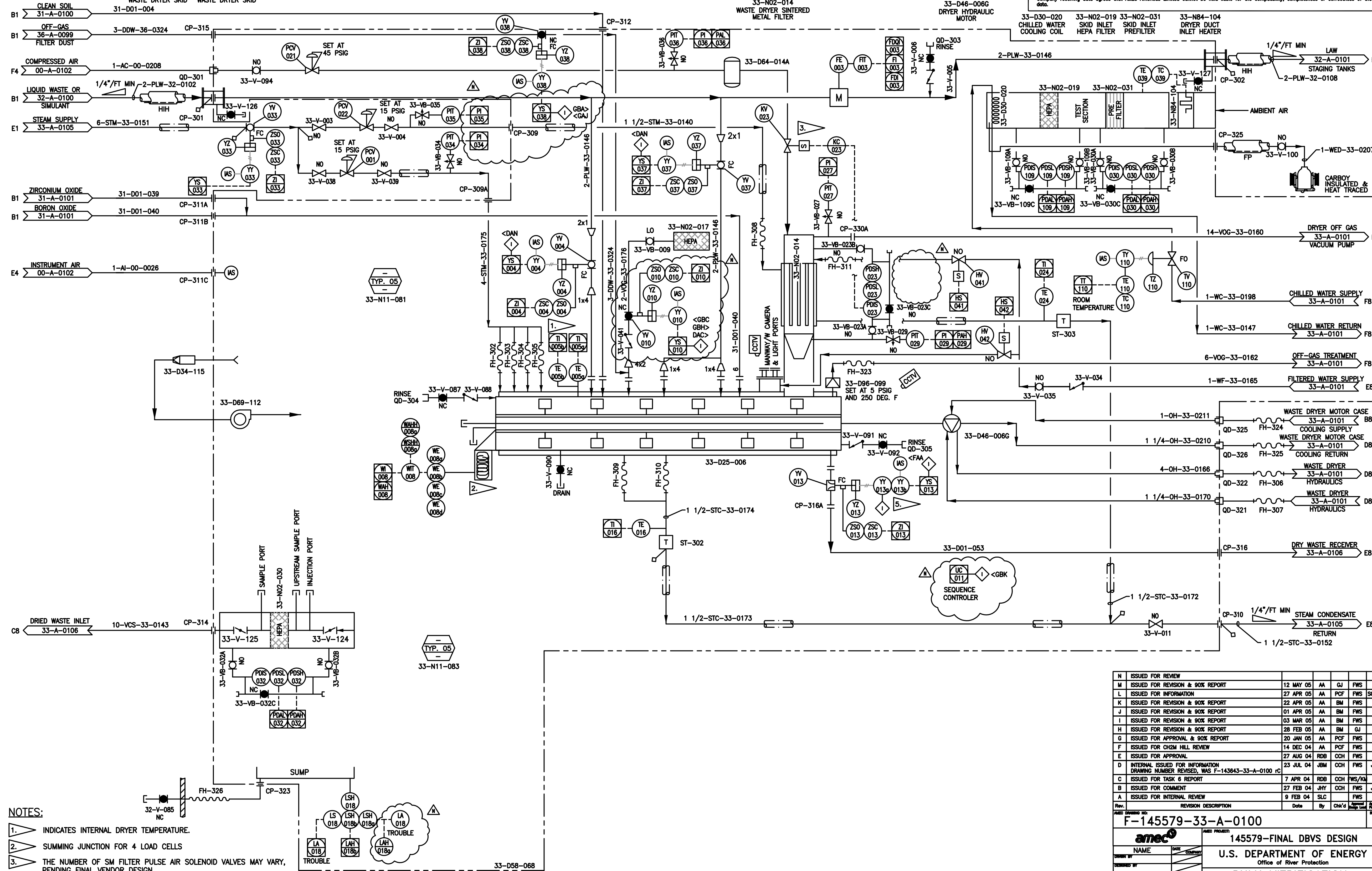
ISO 668	*Series 1 Freight Containers Classification, Dimensions and Ratings,* International Organization for Standardization, Geneva, Switzerland.
ISO 1161	*Series 1 Freight Containers – Corner Fittings – Specification,* International Organization for Standardization, Geneva, Switzerland.
ISO 1496-2	*Series 1 Freight Containers – Specification and Testing – Part 2: Thermal Containers,* International Organization for Standardization, Geneva, Switzerland.
MSS SP-72	*Ball Valves with Flanged or Butt-Welding Ends for General Service,* Manufacturing Standardization Society of the Valve and Fittings Industry, Inc. Vienna, Virginia.
MSS SP-82	*Valve Pressure Testing Methods,* Manufacturing Standardization Society of the Valve and Fittings Industry, Inc. Vienna, Virginia.
NEMA MG-1	*Motors and Generators,* National Electrical Manufacturers Association, Rosslyn, Virginia.
NFPA 70	*National Electrical Code*, 2002 Edition, National Fire Protection Association, Quincy, Massachusetts.
SAE J429	*Mechanical and Material Requirements for Externally Threaded Fasteners,* Society of Automotive Engineers, Warrendale, Pennsylvania.
UBC, 1997	*1997 Uniform Building Code*, International Conference of Building Officials, Whittier, California.
UL-Listed	*Electrical Appliance and Utilization Equipment Directory,* Underwriters Laboratories, Inc., Northbrook, Illinois.
UL 142	*Standard for Safety-Steel Aboveground Tanks for Flammable and Combustible Liquids,* Underwriters Laboratories, Inc., Northbrook, Illinois.
UL 508A	*Standard for Industrial Control Panels,* Underwriters Laboratories, Inc., Northbrook, Illinois.

ATTACHMENT D

WASTE DRYER SYSTEM
PIPING AND INSTRUMENTATION DIAGRAMS

1. **Drawing F-145579-33-A-0100, Rev N, "Bulk Vitrification Waste Dryer P&ID"**

2. **Drawing F-145579-33-A-0101, Rev M, "Bulk Vitrification Waste Dryer Vacuum P&ID"**



In making requests for transmittal of data by any electronic media, the Company receiving such data agrees that AMEC Americas Limited cannot be held responsible for users of the data outside of or beyond the scope of our original agreement. Also, because data stored in electronic media or transmitted by electronic means can deteriorate undetected or be modified without the consultant's knowledge, the Company receiving data agrees that AMEC Americas Limited cannot be held liable for the compatibility, completeness or correctness of the data.

NOTES:

1. INDICATES INTERNAL DRYER TEMPERATURE.
2. SUMMING JUNCTION FOR 4 LOAD CELLS
3. THE NUMBER OF SM FILTER PULSE AIR SOLENOID VALVES MAY VARY, PENDING FINAL VENDOR DESIGN. ALSO NOTE THAT KC-023 TO BE LOCATED OUTSIDE OF SHIELD WALL.
4. INTERLOCK INFORMATION TO BE UPDATED
5. SAFETY SYSTEM INTERLOCK FROM 35-FSL-112 CLOSES VALVES 33-YV-013, 34-YV-124, 34-YV-126 & 35-HV-115.

33-N11-083 WASTE DRYER SKID UNIT HEATER #2

33-D58-068 WASTE DRYER SKID (ISO CONTAINER)

DWG NO	TITLE
-	

DRAWING TRACEABILITY LIST

REF NUMBER	TITLE
-	

REFERENCES

NEXT USED ON

Rev.	REVISION DESCRIPTION	Date	By	Chk'd	Approved Design Lead	Approved Proj Mgr
N	ISSUED FOR REVIEW					
M	ISSUED FOR REVISION & 90% REPORT	12 MAY 05	AA	GJ	FWS	TH
L	ISSUED FOR INFORMATION	27 APR 05	AA	PCF	FWS	SC/TH
K	ISSUED FOR REVISION & 90% REPORT	22 APR 05	AA	BM	FWS	TH
J	ISSUED FOR REVISION & 90% REPORT	01 APR 05	AA	BM	FWS	TH
I	ISSUED FOR REVISION & 90% REPORT	03 MAR 05	AA	BM	FWS	TH
H	ISSUED FOR REVISION & 90% REPORT	28 FEB 05	AA	BM	GJ	TH
G	ISSUED FOR APPROVAL & 90% REPORT	20 JAN 05	AA	PCF	FWS	TH
F	ISSUED FOR CH2M HILL REVIEW	14 DEC 04	AA	PCF	FWS	TH
E	ISSUED FOR APPROVAL	27 AUG 04	RDB	CCH	FWS	TH
D	INTERNAL ISSUED FOR INFORMATION DRAWING NUMBER REVISED, WAS F-143643-33-A-0100 rC	23 JUL 04	JBM	CCH	FWS	JDS
C	ISSUED FOR TASK 6 REPORT	7 APR 04	RDB	CCH	FWS/KM	TH
B	ISSUED FOR COMMENT	27 FEB 04	JHY	CCH	FWS	JDS
A	ISSUED FOR INTERNAL REVIEW	9 FEB 04	SLC		FWS	

AMEC DRAWING NO: F-145579-33-A-0100 REV N

amec

AMEC PROJECT: 145579-FINAL DBVS DESIGN

U.S. DEPARTMENT OF ENERGY

Office of River Protection

BULK VITRIFICATION WASTE DRYER P&ID

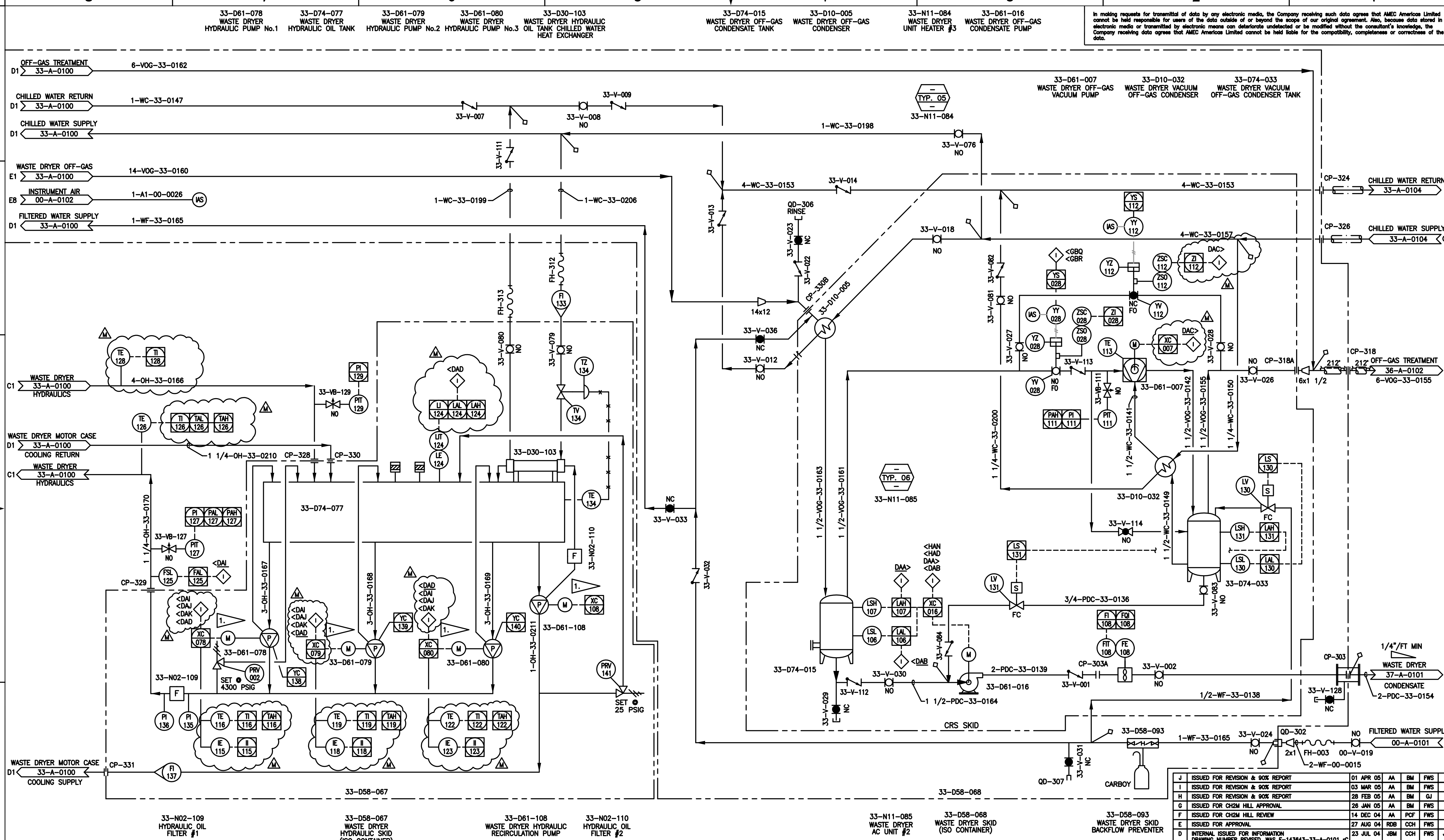
NAME | DATE | COMPANY

DRAWN BY / DESIGNED BY / CHECKED BY / DESIGN / AREA LEAD / ENGINEERING MANAGER / PROJECT MANAGER / DESIGN AUTHORITY

SIZE F | BLDG NO | INDEX NO | DWG NO | REV

SCALE | EDIT | SHEET OF

REVISIONS



Rev.	REVISION DESCRIPTION	Date	By	Chk'd	Approved Design Lead	Approved Proj Mgr
M	ISSUED FOR REVIEW					
L	ISSUED FOR INFORMATION	27 APR 05	AA	PCF	FWS	SC/TH
K	ISSUED FOR REVISION & 90% REPORT	22 APR 05	AA	BM	FWS	TH
J	ISSUED FOR REVISION & 90% REPORT	01 APR 05	AA	BM	FWS	TH
I	ISSUED FOR REVISION & 90% REPORT	03 MAR 05	AA	BM	FWS	TH
H	ISSUED FOR REVISION & 90% REPORT	28 FEB 05	AA	BM	GJ	TH
G	ISSUED FOR CH2M HILL APPROVAL	26 JAN 05	AA	BM	FWS	TH
F	ISSUED FOR CH2M HILL REVIEW	14 DEC 04	AA	PCF	FWS	TH
E	ISSUED FOR APPROVAL	27 AUG 04	RDB	CCH	FWS	TH
D	INTERNAL ISSUED FOR INFORMATION DRAWING NUMBER REVISED, WAS F-143643-33-A-0101 rC	23 JUL 04	JBM	CCH	FWS	JDS
C	ISSUED FOR TASK 6 REPORT	7 APR 04	RDB	CCH	FWS/KM	TH
B	ISSUED FOR COMMENT	27 FEB 04	JHY	CCH	FWS	JDS
A	ISSUED FOR INTERNAL REVIEW	9 FEB 04	SLC		FWS	

NOTES:

1. HYDRAULIC PUMPS ARE CONTROLLED THROUGH A WASH PLATE SOLENOID AS PART OF THE PUMP W/A CONTROL SIGNAL FROM THE MCS
2. INTERLOCK INFORMATION TO BE UPDATED

DWG NO	TITLE	REF NUMBER	TITLE
-		-	
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS

AMEC DRAWING NO: F-145579-33-A-0101 REV M

amec

AMEC PROJECT: 145579-FINAL DBVS DESIGN

NAME / DATE / COMPANY: DRAWN BY; DESIGNED BY; CHECKED BY; DESIGN / AREA LEAD; ENGINEERING MANAGER; PROJECT MANAGER; DESIGN AUTHORITY

U.S. DEPARTMENT OF ENERGY
Office of River Protection

BULK VITRIFICATION WASTE DRYER VACUUM P&ID

SIZE F | BLDG NO | INDEX NO | DWG NO | REV
SCALE | EDT | SHEET OF

APPENDIX E

Corrosion Engineering Review

Northwest Corrosion Engineering

10995 Warfield Road, Sedro-Woolley, WA 98284
Phone: (360) 826-4570 Fax: (360) 826-6321

March 9, 2005

Mr. Karl Walterskirchen
TechnoGeneral Services Company
710 North 4th Avenue
Pasco, WA 99301

SUBJECT: Corrosion Engineering Review – DBVS Waste Dryer System Review, Package 2.2 Revision B February 8, 2005

Mr. Walterskirchen,

Documents pertaining to the Demonstration Bulk Vitrification System - Waste Dryer System, Package 2.2 Revision B February 8, 2005 were reviewed from a corrosion engineering perspective. Comments pertaining to the review are outline below.

1.0 Corrosion Review – Submitted by ChemMet LTD, Co., dated January 28, 2005.

1.1 Dryer and Condensate Recovery System (143643-D-SP-001)

Northwest Corrosion Engineering does not take any exceptions to the comments provided by Dr. Divine in his review of the Dryer and Condensate Recovery System (143643-D-SP-001).

1.2 Dryer and Condensate Recovery System Skid (145579-D-SP-006)

Northwest Corrosion Engineering does not take any exceptions to the comments provided by Dr. Divine in his review of the Dryer and Condensate Recovery System Skid (145579-D-SP-006).

1.3 Other Comments & Recommendations

Northwest Corrosion Engineering does not take any exceptions to the comments provided by Dr. Divine in the Other Comments & Recommendations of the ChemMet LTD corrosion review.

2.0 The following additional comments concerning Technical Specifications 143643 D-SP-001 and 145579-D-SP-006 are being provided by Northwest Corrosion Engineering.

2.1 143643-D-SP-001 Rev. 0 – Dryer and Condensate Recovery System

a. Section 3.3.6 Protective Coatings requires that "Protective coating specifications shall be submitted to the Buyer for review and approval before fabrication". A specific Amercoat Primer is not called out in section 3.3.6.2. Reliance has been placed upon the Seller to comply with manufacturer's

recommendations for materials, surface preparation, application procedures, environmental controls, etc. As protective coatings are used as the first line of defense against corrosion, it would be prudent to provide the Seller with coating specifications specific to the items to be coated. This will require the Seller to recognize and prepare for a specific set of coating instructions.

b. Provisions should be made to perform 3rd party coating inspection at the application location.

c. Section 4.3 Inspections and Tests paragraph 2 requires that water used for testing shall be tested for chlorides and rejected if chloride concentration is greater than 250 ppm for water temperature less than 149°F. To reduce the possibility of stress corrosion cracking, water used for hydrostatic testing of austenitic stainless steels should contain less than 200 ppm chlorides. After hydrostatic testing is complete, the materials should be immediately flushed with fresh water and dried by circulating air or wiping.

2.2 145579-D-SP-006 Rev. 2 – Dryer and Condensate Recovery System Skid

a. Section 3.3.6 Protective Coatings does not specify the coating products to use, application methods, environmental controls, or inspection criteria. At a minimum, all coating related work (including products, environmental constraints, surface preparation, coating application methods, and inspection criteria) should be reviewed and approved prior to application. Ideally, the Seller would be provided with a complete and thorough set of coating specifications that outline all coating related requirements.

b. Provisions should be made to perform 3rd party coating inspection at the application location.

c. Section 4.2 Inspections and Tests paragraph 2 requires that water used for testing shall be tested for chlorides and rejected if chloride concentration is greater than 250 ppm for water temperature less than 149°F. To reduce the possibility of stress corrosion cracking, water used for hydrostatic testing of austenitic stainless steels should contain less than 200 ppm chlorides. After hydrostatic testing is complete, the materials should be immediately flushed with fresh water and dried by circulating air or wiping.

d. Section 5.2 Preservation and Packaging requires that defects in the paint shall be touched up or repaired. Again, reliance is placed upon the Seller to complete this task without specific instruction on how to do so and any subsequent testing of touch ups or repairs. Stand-alone coating specifications would address these issues in a specific manner.

e. Drawing 056-001-2-010 Engineering Data Item 3 states the "Non stainless exterior is painted Amercoat 220 (color T.B.D.) 5 mil thickness." Information is not provided as to the required primer coat materials.

3.0 General Notes:

a. During bench scale testing, it will be imperative to collect corrosion measurements. The use of corrosion coupons and ultra-sonic thickness testing will yield valuable information as to the corrosive nature of the process fluid in contact with the proposed containment materials.

b. The final design should provide for the installation of corrosion coupons installed directly into the waste product stream. This will provide information as to the corrosion resistance of various alloy materials to the waste fluid.

c. Preliminary research was completed to determine if standard industry recommended practices exist to guide hydrostatic pressure testing materials and procedures. Both ASTM and ASME standards provide guidelines as to test pressures and hold times, but specific information was not found that describes chloride concentration limits in the test media. Due to concerns related to stress corrosion cracking, both NORSOK Standards and the Nickel Development Institute recommend that hydrostatic testing and flushing of stainless steel piping be completed with test media containing less than 200 ppm chlorides.

d. Project specific coating specifications should be developed and issued with the design package. This will ensure that the protective coatings will be compatible with the materials and environments to which they are exposed. In addition, provisions should be made for 3rd party coating inspection to be completed. The inspection would take place at specific hold points as described in the coating specification.

The comments provided in this review are based upon the specific technical specifications as described at the 90% level of design.

Sincerely,
Northwest Corrosion Engineering

Jeremy A. Hailey, P.E.
NACE Corrosion Specialist, No. 5401

4.0 REFERENCES:

1. ASTM A 999/A 999M, *Standard Specification for General Requirements for Alloy and Stainless Steel Pipe*, American Society of Testing and Materials, West Conshohocken, Pennsylvania.
2. ASME B31.3, *Process Piping*, American Society of Mechanical Engineers, New York, New York.
3. Nickel Development Institute, *Design, Water Factors Affect Service-Water Piping Materials*, NiDI Technical Series No. 10043, Toronto, Ontario
4. NORSOK Standard L-CR-004, *Common Requirements – Piping Fabrication, Installation, Flushing, and Testing*, Norway